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THE SCRUB-TYPHUS AND SCRUB-ITCH MITES (*TROMBICULIDAE*, ACARINA) OF THE ASIATIC-PACIFIC REGION

PART 1 (TEXT)

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PREFACE

THE Trombiculidae, a family of Acarina (mites), are in their larval stage external parasites of vertebrates and more rarely of invertebrates.

In general the species are not host specific, as many are known to occur on two or more kinds of animals, and secondarily also on man. In a few cases the same species is to be found on both vertebrate and invertebrate hosts.

Many species have been known for a very long time to be a source of extreme annoyance to man in that they produce an "itch," while in some countries their association with a typhus-like disease in man has been suspected for centuries past. During the last two or three decades, and especially during the course of the last war in the Pacific Region, the association of these mites with the disease "tsutsugamushi" or "river fever" of Japan, China, etc., and "scrub typhus" in New Guinea, Malaya and Queensland, has been very intensively studied by the personnel of the Medical Army Services of Britain, United States of America and Australia. As a result, two species, *Trombicula* (*Leptotrombidium*) *akamushi* (Brumpt) and *T.* (*L.*) *deliensis* (Walch) have been definitely incriminated as vectors of the organism of this disease.

The possibility that others of the many species as yet only responsible for an "itch" in man, may be potential carriers of the disease from the primary host, has rendered the detailed taxonomic study of these mites a matter of the utmost importance to those engaged in the study of Tropical Diseases.

The writer first became interested in this particular group of Acarids in 1940 when, because of the association of certain species with disease in New Guinea and Northern Queensland, a survey of our then knowledge of the group in the Austro-Malayan and Oriental Regions was published jointly with W. G. Heaslip in the Trans. of the Roy. Soc. of South Australia, 67, (1), 1943.

With the development of war operations in New Guinea and the Pacific generally, that publication became a basis for the determination of the larvae met with by officers of the British, American and Australian Forces, and very large numbers of specimens were forwarded to the writer at the South Australian Museum for critical determination and study.

As was to be expected, many new species were recognized and our knowledge of the taxonomy, as well as the distribution of the Trombiculidae of the Asiatic-Pacific Region has been very materially increased.

Apart from my own studies of this material, a number of new species have been described by other workers engaged on ecological and medical aspects of the scrub typhus problem during the later period of the war. Amongst these must be mentioned Lt.-Col. C. B. Philip and his colleagues Major G. M. Kohls,

Major R. Traub, of the American Army, Lt. G. W. Wharton of the U.S. Navy, and Squadron Leader C. D. Radford, of the British South-East Asia Command. To all these colleagues I am indebted for a large amount of material, including paratype specimens of their species.

Since 1947, I have also received an immense amount of interesting material, including many new or rare Malayan and Borneo species from Dr. J. R. Audy, in charge of the Brit. East Asia Scrub-typhus Commission in Kuala Lumpur.

Further, the close association of the above-mentioned workers, most of whom were able to visit Adelaide at some time during the war, and whom I was again able to personally meet in 1947 in America and England, has very greatly stimulated my own studies and been of the greatest help. To all of these colleagues I desire to express my greatest appreciation.

The realization of the paucity and scatter of published knowledge of these mites stimulated the writer to consider the publication of a monographic revision of the species of Trombiculidae of the Asiatic-Pacific Region. In 1947 a plan was put forward to this effect, and a generous grant was received from the Research Grants Division of the United States National Institute of Health, to enable the writer to visit institutions in the United States, Britain, and Europe to study further material, and as a grant in aid of the subsequent publications of such a revision. To the Research Grants Committee and especially to Dr. G. B. Philip of the Rocky Mountain Laboratory, Hamilton, Montana, who sponsored my application, I desire to express my deep appreciation. Further finance towards publication was met by the Board of the South Australian Museum, in whose Museum Records the work is now published. For this and for the facilities to carry out the studies as part of my official duties, my sincere appreciation is also gratefully acknowledged.

As originally planned the publication was to include also the allied family of "itch mites," the Leeuwenhoekiidae, as well as an atlas of micro-photographs of the dorsal scutum of all species, of which the material available was suitable. However, the recent great increase in the cost of printing and block-making, and the limited finance available, has regrettably caused these portions to be omitted for the present. The work, therefore, is restricted to the Trombiculidae only, with line figures of the species.

In the taxonomy of these mites, the classification now adopted has been based on a study of the adult and nymphal forms from the whole world, and consequently many of the larval genera hitherto proposed have been dropped or reduced at the most to subgenera based on larval characters.

In conclusion, appreciation of the help and encouragement of many colleagues, mentioned from time to time in the text, is sincerely tendered.

H. WOMERSLEY.

ADDENDA AND CORRIGENDA

(See also page 427.)

A description of the circumstances of collections during World War II in Assam and North Burma by members of the U.S. Typhus Commission (Fuller, Traub, Sundermeyer, etc.) is given by Mackie *et al.* (Trans. R. Soc. trop. Med. Hyg., 1946, 40, 15), while those in Manipur, South Burma, and also Malaya and Sarawak, are given by Audy and Harrison (*Ibid.*, 1951, 44, 371).

The collection in Manipur (Imphal) area and in South Burma was made by the Scrub Typhus Research Laboratory, South East Asia Command, from March 1945 to March 1946. Squadron Leader C. D. Radford was attached to this unit for a period and described fifteen new species from the Imphal area (Proc. Zool. Soc. Lond., 1946, 116, 247); he was followed in the laboratory by three of his pupils, G. W. Ash, W. K. Ford, M.Sc. (Liverpool Museum), and later T. J. Lawrence (all at the time in the Royal Army Medical Corps). Lawrence prepared a manuscript account, including some new names and temporary designations; but he was unable to follow this up after demobilization. A summary of his draft manuscript (without names) formed Appendix 7 of the mimeographed War Office report (1947) referred to in the text (vide abstract in Trop. Dis. Bull., 1948, 45, 62). T. J. Lawrence's species have been redescribed and drawn, with the retention of his names and authorship (viz. *T. lanceolata, T. macacus, T. fordi,* spp. n. Lawrence in Womersley 1952).

Radford's host-data were based on provisional identifications in the field, since revised by Roonwal (Trans. nat. Inst. Sci. India, 1949, 3, 67). His *R. r. rufescens* and *R. r. nitidus*, and the *R. r.* nr. *brunneusculus* of the War Office report (in the present text referred to as *R. r. brunneusculus*) are all correctly to be identified as *R. r. bullocki* Roonwal 1948 (Proc. nat. Inst. Sci. India, 14, 386). *Hydromys humei* is a misprint for *Hadromys humei* (vide *S. lacunosa, S. lewthwaitei* spp. n.)—*Hydromys* is an Australian genus of water rats.

Collections in South Burma ascribed to Lawrence were made by Ash and Audy. The following host-data of South Burma chiggers should be amended: *Nesokia* is a synonym of *Bandicota* (*B. bengalensis*). The hosts of *S.* (*A.*) *audyi* sp. n. are *R. rattus* subsp. (not *R. norvegicus*) in Toungoo, and the Pagoda Rd. locality refers to Rangoon ("R.G.N.") This is incidentally now known to be the commonest chigger in squirrels in the forest in Malaya, and

is the "species 'S' " referred to by Audy and Harrison (1951). The hosts in Southern Burma of *S.* (*A.*) *soakaboemiensis* should read *Bandicota bengalensis*, *R. rattus* nr. *khyensis* (not *R. rattus norvegicus*). The hosts of *T. fordi* sp. n. should read *R. r. bullocki* (not *R. r. brunneusculus*) and the common Indian shrew *Suncus coeruleus* (misprinted *Scincus*).

The following notes and amendments apply to collections from Malaya and Sarawak (Borneo), which were made by the Colonial Office Scrub Typhus Research Unit (Institute for Medical Research, Kuala Lumpur), (this and the Imphal Military Laboratory are variously referred to in the text) : References made by Gater, and here reproduced, to *Rattus malaisia* Kloss refer in fact to a subspecies, the tree rat *Rattus canus malaisia.* (vide *T. munda, T. spicea, S. malayensis*, etc.). The host of *S.* (*A.*) *malayensis* is *Rattus canus* and this mite appears to be one of the few host-specific chiggers—the reference to its occurrence on *R. sabanus* and *R. whiteheadi* is erroneous. The data for *T. muridia* sp. n. should be corrected to read: specimen No. 6,451 on R. 7,246 *R. mulleri*, 25 July, 1949. Identifications of certain bats have recently been confirmed: R.10,299 (host of *T. leveri* sp. n. in Malaya) is *Emballonura monticola*; R.11,018 (host of *T. harrisoni* sp. n.) is *Hipposideros* sp.; R.10,566 (host of *S. lipoxena* sp. n.) is also *Hipposideros* sp. (the number 13,944 refers to the first chigger specimen-number).

Most collections in Malaya have come from areas within 15 miles of the capital, Kuala Lumpur, in Selangor State. The island Jarak and the twin islands Seletar (bat-cave) and Angsa are in the Malacca Straits, respectively at 3° 59′ N., 100° 6′ E., and 3° 12′ N., 101° 13′ E.

Collections made by Major S. Lal Kalra, I.M.S./I.A.M.C., in charge of the Field Typhus Research Detachment (formerly with the Imphal team), have been in the Kumaon Hills (*circa* 79° 30′ N., 79° 30′ E.) and Kashmir (Simla Hills, etc., 33° 30′ N.—34° 30′ N., 72° 40′ E.—75° 30′ E.).

Page 2, in line 21 for "G. B. Philip" read "C. B. Philip".

Page 3, in first line of paragraph 2 of Introduction for " (146) " read " (142a) ", and in Bibliography on page 417, after "142" insert "142a Sambon L. W. 1923. The parasitic acarians of animals and the part they play in the causation of the eruptive fevers and other diseases of man. Preliminary consideration based upon an ecological study of typhus fever".—Ann. Trop. Med. and Parasitol., *22*, 460.

Page 6, in line 3 for "Bête range" read "Bête rouge".

Page 9, in line 16 for "221" read "222".

Page 33, in line 7 transpose "ue" in *kuekenschrijveri* to "eu".

Addenda and Corrigenda

Page 46, in bottom line before *Trombiculindus* insert "(", and after "1951" insert ")".

Page 55, in line 3 for "T. H. Lawrence" read "T. J. Lawrence".

Page 81, in line 2 for "1945" read "1944", and in line 3 for "(*Zephronia* sp.) read "(*Sphaeropaeus globus-magicus* Jeekel 1951)".

Page 109, in the description of *Trombicula parmifera* sp. n. no reference is made to the peculiar structure of the seta on coxae III; this is short and strongly swollen in the basal half and fine distally.

Page 111, in line 19 for "C. Lundblad" read "O. Lundblad".

Page 129, line 25 and elsewhere for "Kukit Lagond" read "Bukit Lagong".

Page 139, following Standard Data for *Trombicula southcotti* sp. n. insert "*Loc. and Host.* The type and two paratypes from the leg of a bandicoot, at Birdum, N.T., Aust., 2 Apr., 1942, (R.V.S.)."

Page 149, in line 19 for "*scabram*" read "*scabrum*".

Page 188, in line 18 for "Wandecla" read "Wondecla".

Page 205, the host of *S. labuanensis* sp. n. should read as "a rat" (not marsupial rat—these are not found in Borneo).

Page 281, delete "With only 1 humeral seta on each side" in line 16, and "6a" in line 17, and insert a fresh line "6a. With only 1 humeral seta on each side" between lines 17 and 18.

Page 303, in line 16 for "bifurcate" read "trifurcate".

Page 307, and elsewhere, for "*longipilis*" read "*longipili*".

Page 336, delete third line from bottom.

Page 355, in line 8 for "*Oniscomorpha* sp." read "*Sphaeropaeus globus-magicus* Jeekel 1951".

Page 379, re *S.* (*A.*) *indica* in line 12 for "reddish in life" read "whitish in life".

Page 389, for "fig. Eu I" read "fig. E–I".

The SCRUB-TYPHUS and SCRUB-ITCH MITES (*TROMBICULIDAE*, ACARINA) of the ASIATIC-PACIFIC REGION

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INTRODUCTION

Although the modern taxonomic descriptions of these mites dates only from 1905, when Oudemans described two species, *Thrombidium wichmanni* and *Th. vandersandei* from New Guinea—both well known causes of "itch" to travellers in that country—their possible association with disease appears to have been suspected from much earlier times.

From the writings of Dr. Louis Sambon (146) it seems that the earliest known recognition of the *sha-shih* (sand mite) as the cause of typhus-like infection in Southern China was the account given in a Chinese work of the 16th Century, the Pen Te'ao Kang Mu by Li Shih-chen. In this account the mite was said to be red in colour, not larger than an ant, and to kill man by burrowing under the skin. It occurred on land and water. The fever caused is now regarded as clinically the same as the "river-fever" or "tsutsugamushi" of Japan.

The earliest published account of the disease itself and its association with a mite was given in a letter from Dr. T. A. Palm (130) to the Rev. J. Lowe and published in the Edinburgh Medical Journal in 1873. The disease was called "Shima-mushi" or "island insect" disease. In 1879 Baelz (16) in a supplementary note to an earlier article by himself and Hawakami (17) describing Japanese "flood fever" recognized it as "Shima-mushi".

The earliest description of the disease in Japan (from Niigata Prefecture) was by Hakuyu Hashimoto in 1810, who called it "tsutsuga". According to Hatori (71) 1919–20, the identity of the disease mite of Japan with the "sand mite" of South China was, however, recognized a century earlier by Genkei Ohtomo, and his son, physicians of the Akito district of Japan.

In 1899 Tanaka (155) considered tsutsugamushi to be almost certainly due to a minute mite, locally called "kedani" or "hairy mite", which was subsequently named *Trombidium akamushi* by Brumpt in 1910. It occurred plenti-

fully on voles but would also attack man and other animals. In this paper Tanaka also indicated that a second species occurred which he called "Yasodani" or "vole mite".

In 1906 Miyajima reared the nymphs of the "kedani" and some ten years later (113) in association with Okumura he was able to rear the adults. From 1916 onwards the study of the Japanese Trombiculid mites was intensively taken up by other workers, notably Nagayo and his colleagues, Kawamura and Yamaguchi, Okumura, etc.

Thus in 1916 (120) Nagayo *et al.* described the nymphs and adults of the tsutsugamushi mite, and in general established its life-cycle. Later in 1917 (121) they further extended their studies and as the nymphal and adult stages differed from those of all other Trombiculid mites known to them, they suggested the generic name of *Leptotrombidium* for *akamushi* Brumpt 1910. Shortly afterwards the work of these students was duplicated by Kawamura (94), while Miyajima and Okumura (115) in a comparison of these mites from Japan, Korea and Formosa accepted Tanaka's view as to the occurrence of two kinds.

Prior to 1916, however, Oudemans had in 1912 (126) published his monograph "Die bis jetzt bekannten Larven von Thrombidiidae und Erythraeidae" in the Zool. Jahrb., Suppl. 14, in which he described, and mostly figured all the then known species of Trombidiid larvae. Of the Japanese species he had very little to say beyond a brief reference to Tanaka 1889, Baelz (16), and to Ashburn and Craig's account (11) of the disease in the Philippines. The mite itself was referred to as "Gen. ? sp. ?". He suggested that these larvae, like the other described species which attack man, probably belonged to the genus "*Microthrombidium*" Haller 1882.

In 1915 (77) Stanley Hirst redescribed and refigured the Japanese species and, following Oudemans, called it *Microtrombidium akamushi* (Brumpt 1910).

In 1919 Nagayo *et al.*, added a third species from Japan, and apparently realising that the adult of *akamushi* was very closely related to the genus *Trombicula* Berl. 1904 (type *T. minor* Berl. 1904 from Java), they dropped their name *Leptotrombidium* in favour of *Trombicula*. In that paper they applied the name of *T. akamushi* (Brumpt) to Tanaka's "kedani, *T. pallida* to Tanaka's "yasodani", and *T. palpalis* to the new species.

In 1921 Nagayo *et al.* (123) described two more species from Japan, *T. intermedia* and *T. scutellaris*. Of the above five species they were able to correlate adults and larvae of *akamushi*, *pallida* and *palpalis*, both by rearing larvae through to the adult and by obtaining larvae from captured adult females; *intermedia* was only got to the pupal stage (nymphophane) between larva and nymph, and *scutellaris* only as far as the nymph.

In 1930 (158) Tanaka described another Japanese species under the name of *T. autumnalis japonica,* relating it to the European *autumnalis* (Shaw 1790). He also reared it through to the nymph which he described and of which he gave a photograph in which the eyes are seen to be placed in front of and away fom the sensillary area of the crista, a feature which places the species in the genus *Tragardhula* Berl. 1912, and distinguishes it from *autumnalis* Shaw.

In January 1950 (133) Philip and Fuller pointed out that a second species, closely allied had been figured by some Japanese workers (Okumura 1918; Kawamura 1926) which had been recognized as distinct by some, and confused by others, but which had remained unnamed. They dedicated the species to Tamiya as *Trombicula tamiyai.*

More recently, Sasa 1950, (148, 149, 150) in Tokyo Ishi Shimshi, Pts. 10, 11, and 12, described three more species from Japan, under the names of *T. nagayoi, T. mitamurai* and *T. burnsi.* The first two species in having a pentagonal scutum and long nude setae on the tarsi and the metatarsi of leg III should probably be placed in *Tragardhula.* The first is closely related to, but appears to be distinct from, *japonica* (Tanaka), while the second is almost identical with *tamiyai* Philip and Kohls, only differing in the number of dorsal setae and the Standard Data. The third species is near to *T.* (*L.*) *pallida* and *T.* (*L.*) *intermedia.*

Thus with a new species of *Gahrliepia* described in the present paper, eleven species of Trombiculidae are now known to occur in Japan.

In Formosa, although the presence of a typhus-like disease was known as early as 1908 it was not until 1919 (71) that Hatori related it to the tsutsugamushi and considered *T. akamushi* (Brumpt) to be the vector. In that paper he also described three other Formosan species, *T. pseudoakamushi* (non Tanaka), *T. corvi,* from crows, and *T. gallinarum* from fowls. The first of these he considered to be the larva of an adult found in a field at Karenko, which after Miyajima he regarded as the same as *mediocris* Berlese 1912 from Java. In 1921 Kawamura confirmed and extended Hatori's work and gave further details of the species including the nymph of *gallinarum.* According to present day nomenclature, *pseudoakamushi* Hatori (non Tanaka) is a synonym of *T. wichmanni* Ouds. 1905, and *gallinarum* is a species of *Neoschöngastia.*

In other parts of the world these mites have long been known as causing an annoying "itch" to humans. The earliest record is that of *Neotrombicula batatas* (L.) from Surinam. Linnaeus quotes this species as having been found by Rolander, and in 1905 Oudemans (126) quotes Müller 1775 as stating that, according to Rolander, *Acarus batatas* crawls on the legs of man and causes an itch. The earliest date given by Sig. Thor and Willmann (1947) is that of Her-

lein 1718 in Beschr. Volk. Plant. Zuriname, p. 179, where it is mentioned under the vernacular "Patattes luis". In other places Martinique, etc., it was known as "Bête-range".

In North America the common itch mite or "chigger" was first described by Riley in 1873 as *Leptus irritans*. As this name, however, had been previously used for any species the synonymy became confused, until 1941–2 (44) when Ewing showed that it should be known as *Trombicula alfreddugesii* Ouds. 1910. Oudeman's proposal of *rileyi* nom. nov for the N. American species is considered by Ewing to be unnecessary owing to the existence of several synonyms, and he suggests that if *alfreddugesii* is invalid, then his name *cinnabarinus* 1921 based on the adult would be applicable. In the adult section of the present paper, however, it is considered that the adults of *alfreddugesii* and *cinnabarinus* cannot be separated, and that Oudeman's name *alfreddugesii* should be used.

In Europe, the earliest scientifically recognizable species is *Neotrombicula autumnalis* (Shaw 1790). This, the "Harvest Mite" of Britain, is known from most European countries where it goes under various local names. It becomes especially numerous at harvest time when it causes considerable annoyance to workers in the fields.

In New Guinea and Malaya "itch mites" were a source of much discomfort to many of the earlier travellers in those parts, and Oudemans 1905 gives a very full account of the many records left by such explorers.

The earliest of these is that of J. H. de Boudijck Bastiaanse in his "Voyages faits dans les Moloques a la Nouvelle Guinee et a Celebes", Paris 1845, where he says that ever and anon on returning from trips ashore or to the forests he was plagued by an itch.

Amongst other records of similar experiences quoted by Oudemans are those of C. B. H. von Rosenberg in "Reistochten naar de Geetvinkbaai op Nieuw Guinea in de Jaren 1869–1870". s'Gravenhage 1872; L. M. D'Albertis in "New Guinea: What I did and what I saw", London 1880; Alfred Russell Wallace in "The Malay Archipelago: The land of the Orang-Utan and the bird of Paradise" 1869; and of the two Sarasin's in "Zeitschrift der Gesellschaft fur Erdkunde zu Berlin", Bd. 29, 1894.

In the descriptive part of his paper Oudemans figures and describes in detail the two species *Trombicula wichmanni*, and *Schöngastia vandersandei*.

In New Guinea, while a form of endemic typhus was known from the Mandated Territory, no cases had been reported from either Papua or Dutch New Guinea until the second World War. Dr. Carl Gunther (Med. J. Aust. 1940) first showed that there was sufficient evidence to indicate that the probable vector in New Guinea was a species of mite, *Trombicula minor* (non Berlese) (= *hirsti*

Sambon 1927). Further work on this mite and on the Trombiculidae of New Guinea in general by Gunther laid the foundation of our pesent knowledge of the mites of this island. He described a number of new species and published much on their ecological relationship.

In Sumatra a kedani (tsutsugmushi)-like fever was reported by Dowden in 1915, and in 1921 E. W. Walch commenced an investigation of the disease at Deli, paying particular attention to the mites which could be associated with it. His results were published in several papers in 1923, 1924 and 1927, in which, besides describing a number of new species of Trombiculidae, he showed that *Trombicula deliensis* Walch was a probable vector in the transmission of the infection from rats to man. Further he was able to rear the larvae of this and other species to the nymphs, which he fully described and figured. Earlier, however (1915) Schuffner had already recorded an undetermined species of mite as attacking man.

The first association of mites with typhus-like infections in Malaya is that of Fletcher, Lesslar and Lewthwaite in 1928. They recorded an outbreak of the disease in 1926, on an oil-palm estate near Kuala Lumpur, when one case was attributed to an "insect bite". In their 1928 paper they listed four species, namely *T. pseudoakamushi* Walch (= *T. hirsti* Sambon), *T. deliensis* Walch, (= *Schöngastia* (*Ascoschöngastia*) *indica* Hirst), and *T.* (= *Schöngastia*) *schuffneri* Walch, all of which had been described from Sumatra by Walch.

Following on this paper, B. A. Gater 1941–2 made a very extensive survey of the Trombiculidae in Kuala Lumpur and the surrounding oil and rubber estates, but confined it to those species found parasitic on rats. He listed three species *T. akamushi, T. deliensis* and *T. hirsti* Sambon as found on labourers and, from another district, *T. acuscutellaris* Walch. He followed Oudeman's classification, and in all recorded eight species of *Trombicula* (three new), two of *Schöngastia* (one new), five of *Neoschöngastia* (= *Ascoschöngastia*) (four new), six of *Gahrliepia* (including *Gateria,* all new), and three new species of *Walchia* (= *Gahrliepia*).

In India the mites associated with typhus-like infections were first studied by Mehta (103) in 1937, although several odd species had been described earlier by Oudemans 1914 (127) and by Hirst in 1915 (78). He recorded both *T. deliensis* and *T. acuscutellaris* as attacking both rats and man, and regarded *deliensis* as the vector.

In Australia the association of mites with the coastal and other tsutsugamushi-like fevers was suggested by Cilento 1923 (31), Hirst 1929 (81) and Matthew 1938, while the studies of Heaslip 1938–9 (74, 75) indicated that *Trombicula deliensis* was most probably the chief vector in Northern Queensland.

The first species known from this country was *T. hirsti* Sambon 1927 (146) from Queensland. Later in 1929, Hirst recorded this species as occurring in South Australia, but later Womersley 1939 (191) showed that the South Australian species was not co-specific with Sambon's species, but was a new species, *T. samboni*. Hirst also described in 1929 *T. novae-hollandiae, Schöngastia antipodianum, S. coorongense,* and *S. dasycerci,* all from S. Australia. In 1934, Womersley (188) added *S. westraliense* from Western Australia and *S. petrogale* from the Musgrave Ranges, S. Australia.

In 1936, (189) an adult Trombiculid, *T.* (*Guntherana*) *tindalei* was described by Womersley from Kangaroo Is., S. Australia, and a larval species *T. macropus* from the Northern Territory.

In 1939, Womersley (191) reviewed and keyed the Australian and New Guinea species, and in addition described the *T. samboni* from S. Australia, recorded *Guntheria kallipygos* Gunther 1939 (= *Guntherana bipygalis* Gunther 1939), and described *Neoschöngastia* (= *Ascoschöngastia trichosuri*) *N.* (=*A.*) *perameles, N.* (= *A.*) *queenslandica, N.* (*A.*) *derricki, N.* (*A.*) *smithi* from Queensland. He also erected the genus *Paraschöngastia* (= *Neoschöngastia* Ewing) for four of Gunther's New Guinea species.

In 1942, (192), an adult, *Trombicula* (*Ipotrombicula*) *elegans* Wom. was described from Lush Is., South Australia.

In 1943 (195) a comprehensive survey of the *Trombiculida* (including *Leeuwenhoekia*) of the Austro-Malayan and Oriental Regions was made, jointly with W. G. Heaslip. In this work a total of 91 species (excl. *Leeuwenhoekia*) with four varieties were listed, described and figured.

Trombicula translucens n. sp. (adult.), *T. scincoides, T. obscura* (= *akamushi*), *T. kohlsi, T. sarcina, Schöngastia pusilla* (= *pseudo-schuffneri* Walch.) *Neoschöngastia* (*Ascoschöng.*) *mccullochi* and *Guntherana parana* (= *bipygalis*) n. sp. were described from Australia or New Guinea in 1944 by Womersley (193).

In 1947, Womersley and Kohls (196) added *Eutrombicula gymnodactyla* n. sp., *Novotrombicula owiensis* n. g. et. sp. from Dutch N. Guinea, *Schöngastid philipi* n. sp., *Oenoschöngastia cana* n. g. et. sp., *Ascoschöngastia* uromys n. sp. and *Ascoschöng. echymipera* n. sp. from New Guinea.

From Burma and Manipur, India, a number of species have been described during the war by Radford, 1946 (136, 137) and also by Traub and his colleagues and by Philip and Fuller (133).

Owing to the many successful rearings of larval species to nymphs during the past decade, especially by officers of the British Scrub Typhus Research Unit in Malaya, it is now possible to clarify the generic classification of these mites,

and to base it on the adult or nymphal stages. With this aim in view, the adults and/or nymphs known from the whole world have been considered. Such a revision shows that many of the larval genera which have been proposed cannot be separated in the nymphal or adult stages, should not be used except perhaps for convenience, as subgenera based on larval features only. It would appear that in this family of mites, we have a very striking example of extreme "larval incongruence".

As an adjunct to the differentiation of larval species considerable use has been made of the Standard Data (linear micrometric measurements) of the dorsal scutum, as first applied by Womersley and Heaslip 1943 (195). Where sufficient specimens of a species, or a population of a species, were available, the Standard Data have been treated statistically, and a theoretical range of the variation to be expected for each measurement, as expressed by $M \pm 3\sigma$, determined. In the condensed data given under each species in the keys, this value is used.

In the present study 221 larval species and 53 adult or nymphal forms are listed, of the latter of which 46 have been correlated with the larvae. From the rest of the world 26 species are dealt with, of which only in 10 have the adults and/or nymphs been correlated with the larvae. Seventy-seven new species are described, mainly from the larvae.

That this list, however, is nowhere near the complete fauna of the area is obvious, and from the rapid increase in our knowledge of these mites during the past 10 years, the mite fauna, when more inaccessible parts are explored, will undoubtedly be much increased, possibly to double the present number of species. It is hoped, however, that the present study will serve as a basis for further and even more intensive work on these mites.

OF VICTORIA

CLASSIFICATION AND SYSTEMATICS.

The classification of this family of mites, which is very extensively based on the larval stages, is an extremely difficult problem in taxonomy and, owing to the very many larval genera which have been proposed by recent workers, as well as to our very great lack of knowledge of the adult stages of most genera, is still in somewhat of a chaotic state.

The family Trombiculidae was erected in 1944 by Ewing to include the subfamilies Hemitrombiculinae Ewing 1944, and Trombiculinae Ewing 1929 (External Parasites, p. 22) for all the then known larval Trombidiidae known to parasitise vertebrates. The other larval Trombidiidae, although little known in that stage, and as far as then known parasitic on invertebrates (as in the allied family Erythraeidae) were left in the Trombidiidae in its restricted sense. The Trombiculidae s.l., however, are now known not to be entirely confined to vertebrate hosts, and several species of this family, *sensu stricta,* and of the Leeuwenhoekiidae occur in numbers on various species of arthropods.

The subfamily Leeuwenhoekiinae was erected in 1944 by the present writer for the genus *Leeuwenhoekia* Ouds. s.l. on the presence in the larvae of a pair of true spiracles, one on each side between the gnathosoma and the first coxae, and leading into the tracheae ramifying through the body.

Later Womersley (1945, Tr. Roy. Soc. S. Aust., 69, (1), 96), raised the Leeuwenhoekiinae to family rank, when it was shown that the adults of *Leeuwenhoekia* (*Acomatacarus*) differed markedly in shape and details of the epistome from those of the Trombiculidae. Ewing 1946 (J. Parasitology, 32, (5), 435) apparently failing to appreciate the fundamental nature of the presence of true stigmata and tracheae in the larvae, and the differences in the adults of the Leeuwenhoekiidae, did not accept this family separation, but divided the Trombiculidae into the four subfamilies; Trombiculinae, Leeuwenhoekiinae, Hemitrombiculinae and Walchiinae.

In 1947 Wharton (J. Parasitology, 33, (4), 380) gave a detailed diagnosis of the Trombiculidae, based on larval characters, after Ewing. In this paper he removed, quite correctly, the aberrant Hemitrombiculinae, retained the Leeuwenhoekiinae, and added another subfamily, the Apoloniinae, to include the genera *Apolonia* Torres and Braga 1939 and *Womersia* Wharton 1947, both of which are closely related to *Leeuwenhoekia* and its allies, in possessing true stigmata and tracheae.

In his key to the subfamilies, Wharton stressed the segmentation of the legs as the primary character, the Leeuwenhoekiinae having all three pairs of legs 6-segmented, i.e. the femur is undivided; the Trombiculinae and Apoloniinae having the femur of all legs subdivided into basi- and telofemur, and all legs therefore 7-segmented; and the Walchiinae with only the first pair of legs 7-segmented.

Apart from the fact that the division of the femur into basi- and telofemur, is not a true articulation, the character as a subfamily one is not important, and if strictly applied, as has been done recently by R. F. Lawrence (Ann. Natal Mus., XI, (3), 1949) leads to some strange relationships. Lawrence's new genus *Sauracarella,* is, in my view, because of the distinct anterior projection of the dorsal scutum and the paired AM scutal setae, better placed in the Leeuwenhoekiinae, despite the clavate or globose sensillae, and the 7-segmented legs. As has been shown elsewhere, the anterior scutal process and the paired AM setae are correlated with characters of the epistome in the adult. The occurrence of clavate sensillae in the Leeuwenhoekiidae, can just as well be expected to occur in this family also, as it does in the Trombiculidae. The absence of stigmata and tracheae is possibly also open to question. This feature, with the stigmata so little chitinized, is so very difficult to see at times, even in freshly mounted specimens, that one must be very careful before asserting their absence.

Other species, difficult to assign on the leg segmentation, are *Schöngastia* (*Ascoschöngastia*) *oudemansi* Walch, *S.* (*A.*) *heaslipi* Wom. and Heasp. and *S.* (*A.*) *traubi* sp. n. In these species, contrary to the rest of the Trombiculinae, the first pair of legs only are 7-segmented, the others 6-segmented. They would, therefore, have to be placed in the Walchiinae (Gahrliepiinae), a group from which they completely differ in the scutum and scutal setae.

The genus *Heaslipia* Ewing 1944 (= *Trombiculoides* Womersley and Heaslip 1943) is erroneously referred by R. F. Lawrence 1949, to the Leeuwenhoekiinae, on the supposed 6-segmented legs. Unfortunately, however, the subdivision of the femora is not shown in the original drawing from which Lawrence drew his conclusion. I have re-examined the specimens in the South Australian Museum, and the legs can now be definitely stated to be all 7-segmented.

There has been a tendency to regard trivial characters as of generic importance, and some of these have been discussed by Lawrence (1949).

The first that need be mentioned is the subdivision of the palpal claw. Ewing has used the bi- or trifurcation of this as generic. As will be seen from

the following descriptions and keys, this feature is not even subgeneric, and both bi- and trifurcate claws occur in different species of the same genus.

Ewing also, has raised genera on the number of dorsal setae, particularly in separating the genus *Acariscus* from *Eutrombicula.* This has been corrected by Michener and others. Similarly, the dentition of the chelicerae, cannot be used as has been done by Lawrence 1949, as more than subgeneric, and even then must be used with considerable discretion and a certain amount of latitude.

However, until more is known of the adults, some larval genera must still be diagnosed on characters, which may ultimately be shown to be of no more than specific value.

The Leeuwenhoekiidae and the Trombiculidae can be separated on the following larval and adult or nymphal characters:

1. Larvae with a dorsal scutum with generally 2 AM (rarely 1 or none) and an anterior median scutal process (? sometimes absent), generally with tracheae and true stigmata (? sometimes absent).
   Adults and nymphs cordate, widest across propodosoma, without medial constriction. Crista anteriorly expanded into a rounded or pointed arrowhead like nasus furnished with two ciliated setae. Eyes present or absent; if present, then 2 + 2, situated in front of and away from sensillary area of crista.
   Family LEEUWENHOEKIIDAE Womersley 1945.

2. Larvae with only 1 AM seta, or none, on scutum and no antero-median scutal process. Stigmata and tracheae absent (? rarely present).
   Adults and nymphs figure-eight shaped, with a distinct medial constriction, and propodosoma not wider than hysterosoma. Crista anteriorly ending in a hyaline dentate epistome furnished with a single ciliated seta. Eyes 1 + 1 ,or absent; when present either closely adjacent to sensillary area, or away from and in front of this area.
   Family TROMBICULIDAE Ewing 1944 (restricted Womersley 1945).

Family TROMBICULIDAE Ewing 1944.

Proc. Biol. Soc. Washington 1944, 57, 101–104; J. Parasitology, 1946, 32, (5), 435–440.

A fresh diagnosis of this family as defined above, based on both larvae and adults or nymphs is as follows:

Larvae. Text fig. 1, A–D. Minute, oval to round, six-legged acarids, furnished with only a single antero-dorsal scutum. The scutum of varied shape, furnished with a pair of filamentous, or globose, or clavate, or lanceolate sensillae, and normally 5 setae (1 antero-median, 2 antero-lateral and 2 postero-

lateral) (in the Gahrliepiinae the antero-median seta is absent); frequently in the Gahrliepiinae (rarely in the Trombiculinae) the scutum is prolonged posteriorly to include some of the setae from the dorsum; or there may be additional setae between the antero- and postero-lateral setae. Eyes usually 2, sometimes only 1 or none on each side, more or less close to the lateral scutal margins. Chelicerae two-segmented, basal segment stout, apically a chitinized curved blade frequently serrated or with strong teeth on the inner (dorsal) edge. Palpi 5-segmented, basal segments each bearing a single, always branched, seta and fused in the median line, and with a median laminate projection extending be-

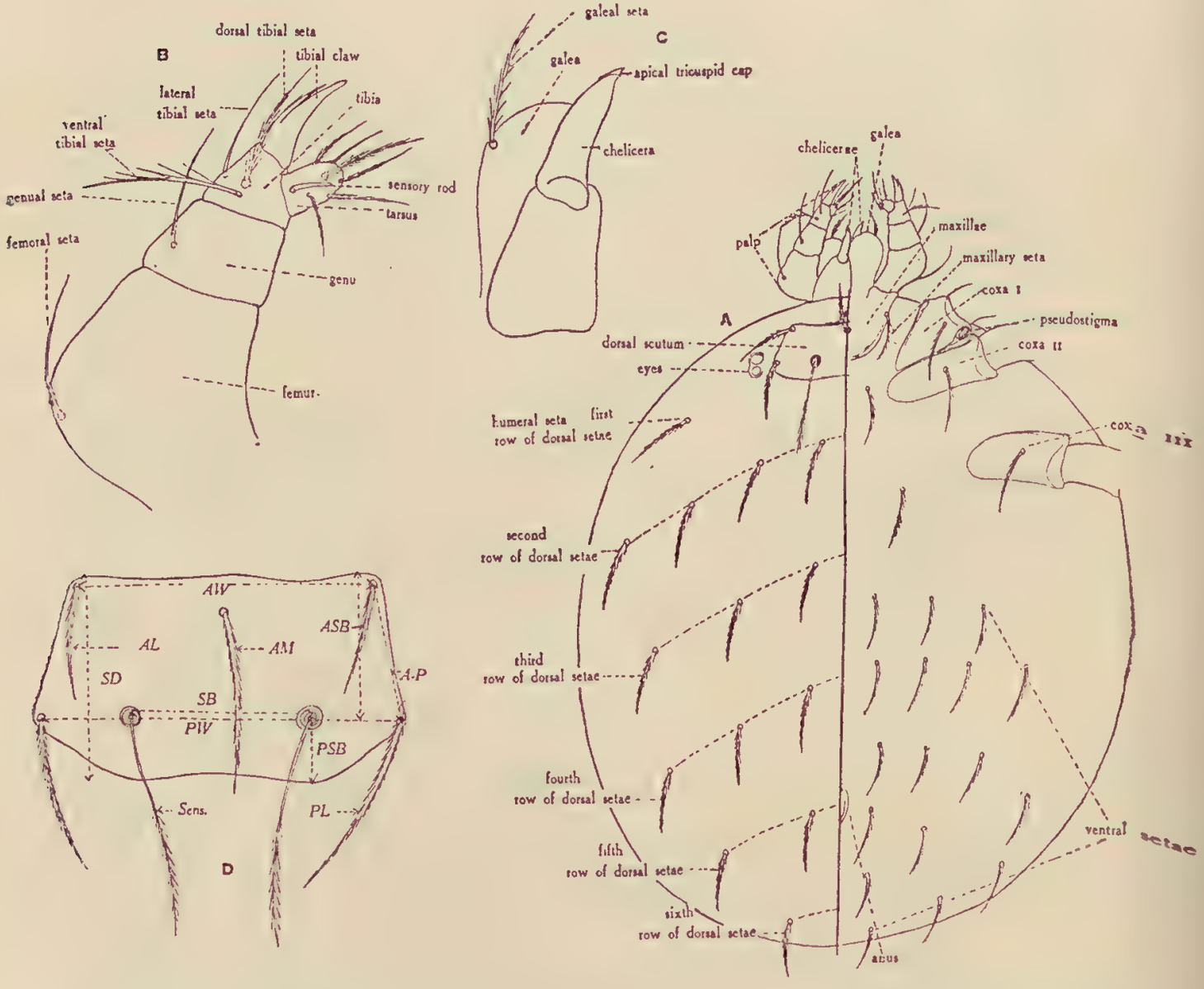


Fig. 1. Details of Larval Characters: A. right ventral and left dorsal halves showing setal arrangement; B. left palp in ventral view; C. mandible and galeal seta; D. dorsal scutum showing method of obtaining Standard Data.

yond basal segments of chelicerae, and with a pair of galeae which curve dorsally over the chelicerae each with a nude or branched seta; the palpal femur is stout, outwardly curved or somewhat angular, and carries dorsally a single nude or branched or ciliated seta; the palpal genu carries a single dorsal similar seta; the palpal tibia is always furnished with 3 setae, one dorsal, one lateral and one ventral, which may be nude or branched; the tibia terminates in a strong claw which may be simple or variously furcate; the tarsus opposes the tibial claw and usually bears 6 to 8 ciliated setae, a subapical nude seta and a sub-basal striated rod-like sensilla. No true stigmata and tracheae are present (except in one species of *Neoschöngastia*). Between coxae I and II is always present a so-called pseudostigmata or "urstigma." Behind the dorsal scutum the dorsal setae are arranged in more or less well defined curved transverse rows; the first row consists of 1 or more humeral setae on each side placed laterad or postero-laterad of the scutum. Generally the legs are 7-segmented due to a secondary division of the femur into basi- and telofemur; occasionally the front legs only have a subdivided femur, the second and third legs being 6-segmented. The tarsi ends in a pair of curved claws, with a median longer and more slender claw-like empodium. In one unique genus the empodium is caruncle-like or pad-like, as in the Parasitidae. Each coxa normally carries a single ciliated seta but frequently some coxae may be multisetose. Tarsi I and II have a dorsal sensory rod, and tarsi III and/or metatarsi III may be furnished with 1 or more long nude outstanding setae.* On the venter between coxae I and between coxae III is a pair of ciliated setae, and behind coxae III the setae are arranged in more or less transverse rows. The anal opening is placed subposteriorly on the venter.

In 1943 Womersley and Heaslip devised a system of linear measurements of the dorsal scutum, and scutal setae, as an adjunct to the normal morphological characters used in the specific identification of Trombiculid larvae. In a more general way, however, somewhat similar scutal measurements had been

* In 1951, Wharton *et al.* (J. Parasitol, 37, (1), 13-31) published an excellent paper on the terminology and classification of the Trombiculid Mites stressing the need for a more exact terminology of the morphological characters of both larvae and adults. While from the viewpoint of comparative morphology their terminology has much to be said for it, from the aspect of the practical taxonomist, many features especially the various small nude sensory setae of the legs, are of little importance and do not appear to offer any practical help in the identification and separation of species. The use of the term "spur" for a short striated blunt seta found on the tarsi of legs I and II is morphologically incorrect. In no sense is it a "spur" and the usual description of it as a "sensory rod" is more descriptive. For the long nude setae found on the femora, tibia and tarsus of the third pair of legs, they use the terms "mastifemoralae, mastitibialae and mastitarsalae." Taxonomically these setae are important, but the above terminology has not been adopted in the present work, as being somewhat unnecessary.

used earlier by Methlagl 1927. "Ueber di Trombidiose in den Oesterreichischen Alpenlandern", Denksch. Akad. Wissen. Wien., 101, 213–250. Methlagl used the ratio of breadth to length of scutum and particularly the ratio of breadth of scutum to the depth between a line at the maximum width and the extreme posterior angle, which he called the "Convexity Factor."

The system of Womersley and Heaslip used a number of scutal measurements, termed the "Standard Data" as follows:

AW. width between the centres of the antero-lateral scutal setae.
PW. width between the centres of the postero-lateral scutal setae.
SB. distance between the centres of the sensillae bases.
ASB. distance from a line joining sensillae bases to extreme point of anterior margin.
PSB. distance from a line joining sensillae bases to extreme point of posterior margin.
SD. Sum of ASB and PSB, i.e. scutal depth.
A–P. distance between antero-lateral and postero-lateral setae in a direct and more or less oblique line, not vertical.
AM. length of antero-median seta.
AL. length of antero-lateral setae.
PL. length of postero-lateral setae.
Sens. Length of sensillae.

The method of making the measurements is clearly shown in text fig. 1, D.

The use of the Standard Data in addition to morphological features should be part of the routine description of larval species of Trombiculid mites, for, in the case of closely similar species it may indicate significant separation on one or more of the Standard Data criteria. Wherever possible, the Standard Data should be based on a number of specimens from the same population, and thus an estimate of the extreme range of variation in a species can be obtained. In some populations, otherwise morphologically the same but from different localities, significant differences in Standard Data values would indicate geographical races, differing only in the overall dimensions of the scutum, or differences in length of scutal setae, SB, etc.

With these ideas in mind, where sufficient numbers are available, the Standard Data for each species dealt with in the present paper, have been treated and expressed statistically. In the keys to species, however, the Standard Data are simplified, and the value for each character is expressed as "Mean $\pm$ 3 $\times$ Standard Deviation," i.e. the theoretical range of variation that might be expected in any one population.

In 1944 (Trans. Roy. Soc. S. Aust., 68, (1), 82–112) and later papers,

Womersley has treated and quoted the Standard Data statistically; and further, where different populations of certain species, e.g. *T.* (*L.*) *deliensis,* etc. appeared to occur, given graphs which showed clearly how the populations or species might be separated. This method is also used in the present studies, where material is sufficient and suitable.

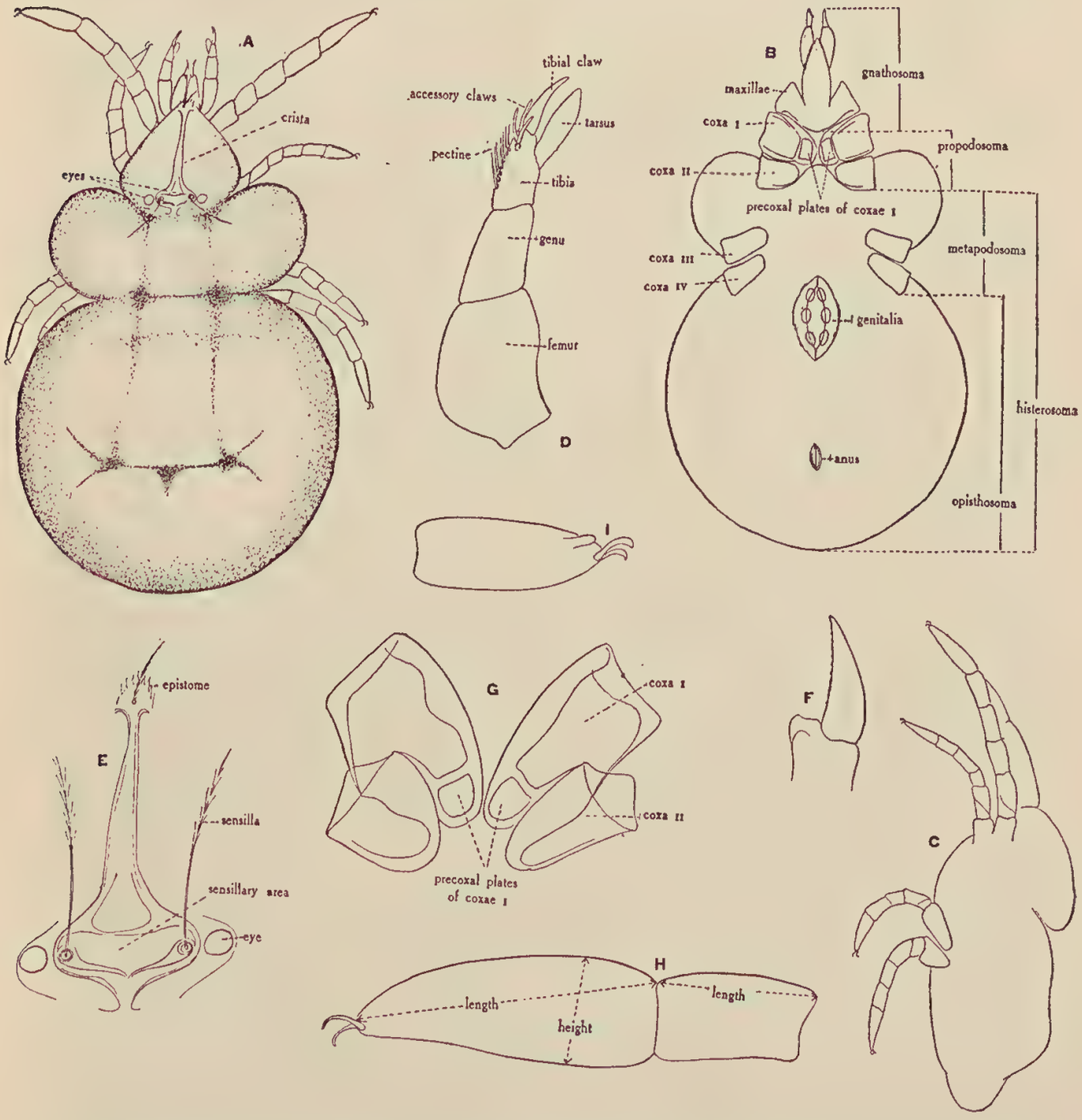


Fig. 2. Details of Adult Characters: A. *Trombicula samboni.* Wom., entire dorsal view; B. diagrammatic view without legs, showing pre-coxal plates of a *Leptotrombidium*; C. side view of a *Trombicula*; D. palp; E. crista, showing eyes, and epistome of a *Trombicula*; F. chelicera; G. coxae I and II showing precoxal plates of a *Guntherana*; H. tarsus and metatarsus of leg III of a *Trombicula,* showing method of measuring; I. tarsi of leg of a *Gahrliepia* showing process.

In addition, another graphic method of separating closely allied species, e.g. *S.* (*A.*) *indica* Hirst and *S.* (*A.*) *soekaboemiensis* Takekawa is indicated in Graph II showing the Regression Lines of AW.PW, for populations of both species. The triangles and circles indicate the frequency of specimens with AW.PW, at the points therein. The elipses are drawn at the range/σ using Tippet's Table (Biometrika, 17, 386, 1925), while the dotted diagonals are the axes of AW and of PW.

Adults (*and Nymphs*). Text fig. 2, A–I. Larger, eight-legged animals of pale to red colour and furnished with a thick pilosity of setae. Form rather squat, with the body divided medially by a constriction giving a characteristic figure of 8 shape. The cephalothorax is rather narrower than the anterior part of the body and triangular in shape; it carries a median longitudinal rod-like crista which is expanded posteriorly or subposteriorly into a wide sensillary area carrying a pair of filamentous or narrowly clavate sensillae. Anteriorly the crista ends in a hyaline rounded or transverse, dentate epistome carrying a single ciliated seta. The eyes when present, are 1 on each side, sessile, and either closely adjacent to the sensillary area, or in front of and away from it. The chelicerae are two segmented, the apical being a strongly chitinized curved blade with finely serrate inner (dorsal) margin. The palpi are 5-segmented, with the basal segments fused medially; the femur is the longest and stoutest; the tibia ends in a strong simple claw at the base of which are 3 to 4 strong spines (2 in nymphs), and there is another, somewhat more tapering about the middle of the outer surface; sometimes the palpal tibia has a pair of pectines or combs; the palpal tarsus is conical, opposed to the tibial claw, and apically bears 5 or 6 short nude setae. The respiratory system is by means of tracheae opening at the base of the mandibles.

Ventrally the coxae are arranged in two groups, widely separated; an anterior group composed of coxae I and II and a posterior group of coxae III and IV. Between the coxae of the anterior group is a generally more or less pentagonal sternum formed by the complete fusion of the precoxae of coxae I; in some cases the precoxae of coxae I are clearly defined and do not quite conjoin to form a sternum, in others they are only partially fused to give a longitudinally divided sternum; no precoxae occur on legs II, III or IV. The legs are 7-segmented with I generally longer and stronger than the others; the tarsi end in a pair of curved claws, those of leg I being much shorter than the rest. The legs and palpi are thickly clothed with setae usually more tapering than the body setae. The genital opening lies just behind or between coxae IV and in both sexes has 3 pairs (2 in nymphs) of genital discs; in the male often the inner genital lips are flanked by one or more pairs of specialized (titillating) setae. The anus is posterior of the genital opening.

LARVAE.

Because of their importance as vectors of scrub-typhus and tsutsugamushi fever, our knowledge of the larval species of the Trombiculidae during recent years has increased tremendously. On the other hand, relatively little is known of the respective adults and only in a small proportion of species have the two stages been correlated. Consequently it is still advisable, as will be done in this work, to deal separately with the known larvae and adults (or nymphs).

Key to the Larval Subfamilies and Genera of the TROMBICULIDAE.

1. With AM scutal seta present. Femora of all legs mostly clearly divided into basi- and telofemur 2
   Subfam. Trombiculinae Ewing 1946.

   Without an AM scutal seta. Femora of leg I subdivided, of II and III not so. Sensillae clavate. (Tarsi I of adults and nymphs with a subapical dorsal process. No sternum or precoxal plates. Eyes absent). 23
   Subfam. Gahrliepiinae *nom. nov.* for Walchiinae Ewing 1946.
   Gen. *Gahrliepia* Ouds. 1912.
   including
   Walchia Ewing 1931
   Schöngastiella Hirst 1915
   Gateria Ewing 1938

2. Sensillae filamentous, more or less with distinct ciliations 3
   Sensillae globose, clavate or lanceolate, nude or setulose 13

3. Dorsal scutum pentagonal. Palpal claw trifurcate or bifurcate. Tarsi and/or metatarsi of leg III frequently with 1 or more long, nude, outstanding setae. (Adults with 1 + 1 eyes, placed in front of sensillary area and away from crista).
   Gen. *Tragardhula* Berl. 1912
   = *Blankaartia* Berl. 1912 (*non* Ouds. 1911).
   = *Pentagonella* Sig Thor 1936
   = *Megatrombicula* Michener 1946

   Dorsal scutum not clearly pentagonal 4

4. Mandibles and palpi short and stout, apparently modified for grasping hair. On bats. Gen. *Myotrombicula* Womersley and Heaslip 1943.
   Mandibles and palpi not so formed 5

5. With more than the 5 normal setae, in addition to the sensillae, on the scutum. Scutum not rectangular, usually longer than wide .. 12
   With only the 5 normal scutal setae (1 AM, 2 AL and 2 PL) in addition to sensillae (PL may occasionally be off the scutum). Scutum usually more or less rectangular, wider than long 6

6. Palpal claw simple. Chelicerae unarmed except for the apical tricuspid cap. Gen. *Crotiscus* Ewing 1944.

   Palpal claw furcate 7

7. Chelicerae with a row of 3 large dorsal (inner) teeth. Scutum vestigial. AM seta spiniform. Sensillae short and simple with bases close together and slightly anterior of line of PL. Palpal claw trifurcate. Gen. *Endotrombicula* Ewing 1931.

   Chelicerae without teeth, only with an apical tricuspid cap 8

8. Palpal claws tri- or quadrifurcate. Scutum small with PL setae well off the scutum. All palpal setae branched. Galeal setae nude.
   Gen. *Tecomatlana* Hoffmann 1947.
   = *Sauriscus* Lawrence 1949.
   = *Trisetica* Traub and Evans, 1950.

   Palpal claws bi- or trifurcate. Scutum not as above 9
   Gen. *Trombicula* Berl. 1905.

9. AL or AM and AL scutal setae short, stout and peg-like. Palpal claw bi- or trifurcate. Subgen. *Fonsecia* Radford 1946.

   The above scutal setae normal 10

10. Palpal claws bifurcate. Galeal setae nude or branched. Tarsi III usually with 1 long nude seta. (Adults with eyes 1 + 1, closely adjacent to sensillary area).
    Subgen. *Trombicula* Berl. 1905, s. str.
    = *Eutrombicula* Ewing 1938
    = *Acariscus* Ewing 1943.

    Palpal claws trifurcate. (Adults without eyes) 11

11. Setae on palpal femur and genu nude; on tibia dorsal seta branched, lateral and ventral nude (except ventral in *palpalis*, etc.). No long nude seta on tarsi or metatarsi of leg III. Galeal setae branched (nude in *myzantha*). (Adults with precoxae on legs I, forming a longitudinally divided sternum).
    Subgen. *Leptotrombidium* Nagayo *et al.*, 1916.

    Without the above combination of characters. Usually without any long nude seta on tarsi or metatarsi III. Galeal setae nude or branched. Subgen. *Neotrombicula* Hirst 1925.

12. Dorsal scutum produced posteriorly, tongue-like so as to take in some of the median setae of some of the dorsal rows. Palpal claw bifurcate. Chelicerae without a prominent dorsal (inner) tooth.
    Gen. *Novotrombicula* Wom. and Kohls 1947.

    Dorsal scutum not produced posteriorly, but with posterior and lateral margins forming a continuous even curve; with 2 extra setae on each side between AL and PL. Palpal claw trifurcate. Chelicerae with a large prominent dorsal (inner) tooth.
    Gen. *Heaslipia* Ewing 1944.
    for *Trombiculoides* Wom. and Heasp. 1943 preoc.

13. Empodium expanded into a pad-like pulvillus. Sensillae globose.
Gen. *Mackiena* Traub and Evans 1950.

Empodium normal, claw-like and slender 14

14. All coxae multisetose. Scutum roughly triangular with apex anterior. Sensillae clavate and setulose. Palpal claw trifurcate.
Gen. *Doloisia* Ouds. 1910.

Coxae I and II always unisetose, III sometimes multisetose. Scutum trapezoidal, pentagonal or hexagonal 15

15. Empodium distally thickened, lancet or blade-like. Eyes absent. Scutum roughly pentagonal with posterior angle. All coxae unisetose. Sensillae globose. Gen. *Reidlinia* Ouds. 1944.

Empodium not as above 16

16. Chelicerae short and stout, curved and stumpy with apex divided into two terminal teeth and two smaller subapical teeth. Palpal claw short and stout, trifurcate. Sensillae globose.
Gen. *Oenoschöngastia* Wom. and Heasp. 1945.

Chelicerae not so as above, more elongate and slender 17

17. Palpal claw simple. Chelicerae unusually long and straight and slender, finely serrate dorsally. Sensillae capitate.
Gen. *Radfordiana* nov.

Palpal claw furcate 18

18. Body constricted medially. Dorsally with a rounded caudal plate, generally longitudinally divided and bearing 3 pairs of fine setae. Palpal claw bifurcate. Sensillae globose, apparently nude. (Adults with sensillary area wider than crista is long. Precoxal plates of leg I distinct and not conjoined to form a sternum. Eyes absent).
Gen. *Guntherana* Wom. and Heasp. 1943.

Body not constricted medially. No caudal plate 19

19. Cuticle of dorsum overlapping posterior half of scutum with semicircular striations thereon. Sensillae globose or clavate, their bases inserted in a transverse wall or crest. Coxae III sometimes multisetose. (Adults with sensillary area kidney-shaped, with striations. Precoxal plates absent. Sensillae lightly clavate or whip-like. Eyes absent.) Gen. *Neoschöngastia* Ewing 1929
= *Paraschöngastia* Wom. 1939.

Cuticle of dorsum not so overlapping scutum, or if so with only transverse striations. Sensillae globose or clavate, their bases not in a crest. Chelicerae simple or with teeth 20
Gen. *Schöngastia* Ouds. 1910

20. Chelicerae non-serrate, with only the apical tricuspid cap 21
Chelicerae with tooth-like serrations 22

21. Palpal claw with 5–7 apical prongs. Sensillae clavate or capitate.
Subgen. *Euschöngastia* Ewing 1938.

Palpal claw bi- or trifurcate. (Adults or nymphs with triangular sensillary area. Eyes and precoxal plates absent, or completely fused to form a sternum.) Subgen. *Ascoschöngastia* Ewing 1945.

22. Chelicerae finely serrated for almost the whole length on dorsal margin. Tarsi I with one short sensory rod. Palpal claw bi- or trifurcate. (Adults and nymphs as in *Ascoschöngastia*).

Subgen. *Schöngastia* Ouds. 1910 s. str.

Chelicerae with only two, more prominent, subapical dorsal teeth. Tarsi I with 4 sensory rods. Palpal claw trifurcate.

Subgen. *Phrynacarus* Lawrence 1949.

23. Dorsal scutum pentagonal, not produced posteriorly to include some of the dorsal setae.

Subgen. *Gahrliepia* Ouds. 1912.
= *Walchia* Ewing 1931.

Dorsal scutum produced posteriorly, tongue-like and generally taking in some of the dorsal setae. 24

24. With only 2 or no additional setae on scutum.

Subgen. *Schöngastiella* Hirst 1915.

With more than 2 additional setae on scutum 25

25. All additional setae on scutum marginal.

Subgen. *Gahrliepia* Ouds. 1912.

Some of the additional scutal setae not marginal.

Subgen. *Gateria* Ewing 1938.

Genus TRAGARDHULA Berlese 1912.

Tragardhula Berl. 1912, Redia, 8, (1), 4.

Blankaartia Berl. 1912, Redia, 8, (1), 96 (*non.* Oudemans 1911. Ent. Ber., 3, (57), 123).

Pentagonella S. Thor. 1936. Zool. Anz., 114, 30.

Megatrombicula Michener 1946. Ann. Entom. Soc. Amer., 39, 432.

Diagnosis as defined in the key to subfamilies and genera of Trombiculidae.

Key to the Larvae from the Asiatic-Pacific Region.

1. Tarsi III and/or metatarsi with some long nude, outstanding setae .. 2

No such setae on tarsi or metatarsi III 5

2. Only 1 long nude outstanding seta on tarsi III, none on metatarsi III 3

Three long nude setae on tarsi III, one such on metatarsi III .. 4

3. PW only a little longer than AW. Dorsal and lateral setae of palpal tibia nude. Galeal setae nude. Dorsal setae 26, arranged 2.6.6.6.4.2, to 72μ long.

AW 77·4±7·8, PW 80·1±7·4, SB 30·8±3·6, ASB 30·0±3·7, PSB 43·3±4·3, SD 72·3±6·1, A–P 25·9±3·5, AM 52·7±6·1, AL 40·25±4·7, PL 77·1±8·0, Sens. 84·0.

Trag. acuscutellaris (Walch 1922)

PW much longer than AW. Setae on palpal femur and genu branched; on tibia dorsal with 1 short branch; lateral nude, ventral branched. Galeal setae nude. Dorsal setae 34, arranged 4.6.6.6.6.4.2, i.e. 2 humeral setae on each side.

AW 83·8±10·3, PW 100·5±22·3, SB 33·0±5·7, ASB 35·5± 3·7, PSB 31·0±4·6, SD 66·5±7·7, A–P 32·5±3·7, AM 62·0,± 7·3, AL 58·8±10·2, PL 73·2±6·4, Sens. 88·0.

Trag. japonica (Tanaka 1930).

4. All setae on palpal tibia branched. Galeal setae nude. Dorsal setae 42, arranged 2.8.8.10.8.6.

AW 64·5±5·9, PW 82·2±8·2, SB 27·25±4·4, ASB 28·25± 4·4, PSB 32·6±5·0, SD 60·9±7·3, A–P 21·55±4·2, AM 44·45 ±6·5, AL 48·0±7·4, PL 62·45±7·9, Sens. 76·0±15·0.

Trag. tamiyai (Philip and Fuller, 1950).

Only ventral seta of palpal tibia branched. Galeal setae nude. Dorsal setae 42, arranged 2.8.8.8(10).10(8).6.4.

AW 60·2, PW 81·2, SB 26·6, ASB 30·8, PSB 30·8, SD 61·6, A–P 25·2, AM 42·0, AL 36·4, PL 46·2, Sens. 80·0.

Trag. fujigmo (Philip and Fuller 1950).

5. Femora of all legs distinctly undivided, i.e. all legs 6-segmented. Galeal setae stout and thickly, shortly, ciliated or pectinate. Setae on palpal femur and genu branched; on tibia, ventral branched, dorsal and lateral nude. Palpal claw bifurcate. Dorsal setae 30 in number, arranged 2.8.6.6.6.2, to 30μ long.

AW 36·4, PW 53·2, SB 12·6, ASB 19·6, PSB 14·0, SD 33·6, A–P 16·8, AM 14·0, AL 25·2, PL 30·2, Sens. 42·0.

Trag. geckobia sp. n.

All legs distinctly 7-segmented, i.e. femora divided into basi- and telofemur. Galeal setae nude 6

6. Anterior scutal margin convex, with AM placed well in front of line of AL. Lateral margins of posterior angle of scutum concave. All setae on palpal femur, genu and tibia branched. Dorsal setae 24, arranged 2.6.6.4.4.2. Palpal claw trifurcate.

AW 51·6±6·18, PW 70·2±8·85, SB 20·8±3·09, ASB 25·3± 2·58, PSB 28·5±2·97, SD 53·5±4·32, A–P 22·3±3·78, AM 34·6±4·29, AL 29·6±2·40, PL 35·0±3·51, Sens. 55·6±6·45.

Trag. pentagona sp. n.

Anterior scutal margin straight, with AM in line with AL. Lateral margins of posterior angle of scutum convex. Seta on palpal femur branched; on genu nude; on tibia, dorsal and lateral nude, ventral branched. Dorsal setae 24, arranged 2.8.6.6.4.2, to 30μ long. Palpal claw bifurcate.

AW 45·75±4·50, PW 60·0, SB 16·5±5·2, ASB 18·0, PSB 23·25 ±4·50, SD 41·25±4·50, A–P 19·5±5·2, AM 24·0, AL 25·5 ±5·2, PL 24·0, Sens. 47·0±5·2.

Trag. gymnodactyla (Wom. and Kohls 1947).

TRAGARDHULA ACUSCUTELLARIS (Walch 1922).

Trombicula acuscutellaris Walch 1922 (1923). Kitasato Archives Exper. Med., 5, (3), 78; *Tromb. a.*, Gater 1932, Parasitol., 24, 143–174; *Pentagonella a.*, Sig Thor 1936, Zool. Anz., 114, 30; *Tromb.* (*Pentag.*) *a.*, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 78; *Tromb. a.*, Metha 1937, J. Med. Res., 25, (2), 253–365; *Tromb. a.*, Williams 1944, Amer. J. Trop. Med., 24, (6), 255; *Tromb. a.*, Philip, Woodward and Sullivan 1946, Amer. J. Trop. Med., 26, (2); *Tromb. a.*, Radford 1946, Parasit., 37, (1–2); *Pentagonella a.*, Sig Thor and Willmann 1947, Das Tierreich, Lfg., 71b., 293 and 296; *Tromb. a.*, Jayewickreme 1947, Nature, 160, 578.

Plate 1, fig. A–D.

This species is widely distributed in the Asiatic-Pacific Region. Originally described by Walch from Sumatra it has since been reported from the Federated Malay States (Gater), India (Mehta), Maldive Islands (Radford), Philippines (Philip) and has also been taken at Labuan, Borneo (R. N. McCulloch); in all cases the hosts were species of *Rattus*.

The nymph was reared from larvae by Radford and briefly described. Jayewickreme in Ceylon has reared them to the adult from larvae through 3 or 4 generations, and study of that material, published in Tr. Roy. Soc. S. Aust., 1948, 72, (1), 83–90, by the present author has shown that it is a species of *Tragardhula*, of which the type is *Trag. nilotica* Trag. (adult).

The specific characters of the larvae are given in the following revised description and in the key to species. In having only one long, nude, seta on tarsi III it is closely related to *japonica* (Tanaka), but differs in having 1 humeral seta on each side and in the galeal seta being nude.

Re-description of Larvae. Colour in life red. Shape oval. Length (unfed) 260μ (excluding gnathosoma), width 195μ. Dorsal scutum (fig. A) pentagonal, with PW only very slightly greater than AW and angle of convexity of posterior margin, i.e. PW/PSB ca. 2·0. Sensillae long and filamentous with ciliations on distal two-thirds. Normal scutal setae ciliated and tapering. Eyes 2 + 2, on ocular shields and posterior eyes the smaller. Palpi (fig. B) stout; femur and genu with a branched or long ciliated seta; trifurcate. Chelicerae (fig. C) with the usual apical tricuspid cap, and on tibia with the dorsal and lateral setae nude, the ventral branched; palpal claw

Of the above Pacific-Asiatic species placed under *Tragardhula*, only *acuscutellaris* (Walch) and *japonica* (Tanaka) are definitely known to truly belong there, on the basis of the adults or nymphs. The others are provisionally placed in the genus on the pentagonal scutum in the larvae. Further rearing studies may prove or disprove this generic placing.

the inner edge a subapical forwardly directed tooth. Galeal setae nude. Dorsal setae 26 in number, arranged 2.6.6.6.4.2, to 70μ long. Ventral setae (excluding the coxae) 24, arranged 2.2.6.4.4.4.2, to 50μ long. Legs long and slender, all 7-segmented; I 350μ long (including coxae), II 392μ, III 435μ; tarsi I and II with the usual dorsal sensory rod, III with one long, fine, nude, sub-basal seta to 80μ long.

The Standard Data derived from 17 specimens bred from eggs laid by a wild adult from Ceylon, 17th Dec. 1947 (S. H. Jayewickreme) and 1 specimen each from Federated Malay States and from Batavia reported upon in 1943 (Womersley and Heaslip) and one from *R. r. norvegicus* from the Maldive Islands, 30 Dec. 1944 (C. D. Radford) are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	77·4±0·58	2·61±0·41	69·6–85·2	70·0–84·0	3·3
PW	80·1±0·55	2·47±0·39	72·7–87·5	75·6–86·8	3·1
SB	30·8±0·27	1·20±0·19	27·2–34·4	28·0–33·6	3·9
ASB	30·0±0·28	1·24±0·19	26·3–33·7	28·0–30·8	4·1
PSB	43·3±0·32	1·43±0·22	39·0–47·6	42·0–44·8	3·3
SD	72·3±0·46	2·04±0·32	66·2–78·4	70·0–75·6	2·8
A–P	25·9±0·26	1·16±0·18	22·4–29·4	25·2–28·0	4·5
AM	52·7±0·49	2·04±0·35	46·6–58·8	50·4–56·0	4·0
AL	40·25±0·35	1·56±0·25	35·5–44·9	39·2–43·4	3·8
PL	77·1±0·61	2·68±0·43	69·1–85·1	75·6–85·1	3·5
Sens.	84·0. No variation recorded.				

TRAGARDHULA JAPONICA (Tanaka 1930).

Leptus autumnalis japonica Tanaka 1916, Igakai Zasshi (in jap.), 30, (22); 1918, Ikai Jiko (in jap.), No. 1,228.

Trombicula autumnalis japonica, (Tanaka *et al.* 1930), Zentbt. Bakt., Abt. 1, Orig., 116, 361.

Pentagonella japonica, Sig Thor 1936, Zool. Anz., 114, 30.

Trombicula (*Pentagonella*) *japonica,* Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1).

Trombicula autumnalis japonica, Sig Thor and Willmann 1947. Das Tierreich, Lfg., 71b.

Trombicula japonica, Philip and Fuller, 1950, Parasitol., 40.

Plate 1, fig. E–H.

There are two distinct species of "akidani" or "harvest" mites figured by various Japanese workers, in one of which the tarsi of leg III have only a

single long, nude, outstanding seta; the other has 3 such setae on tarsi III and also 1 on metatarsi III.

From Tanaka's 1930 paper, the first of these would appear to be the one to which he attached the name *autumnalis japonica*. The second form does not appear to have been given a specific name by Japanese workers but rather to have been confused with Tanaka's species. Its distinctiveness, however, has now been recognized by C. B. Philip and H. S. Fuller, who have described it as a new species *tamiyai*.

That the species is now to be placed in the genus *Tragardhula* is shown by Tanaka's reference (1930) to the position of the eyes in the nymph, which he was able to rear, as being away from and in advance of the sensillary area, as in the type of *Tragardhula, nilotica* Berl. (*non.* Ouds.).

The position of the eyes is also clearly shown on Tanaka's figure 37 on Plate IV. His referring of the Japanese form to a subspecies of the European *autumnalis* is thus shown to be untenable, for *autumnalis* belongs to *Neotrombicula*, a subgenus of *Trombicula* Berl., in which eyes are entirely wanting. The species is closely related to *acuscutellaris* but differs as given in the key to species. Specimens agreeing with Tanaka's description (1930) and figures have been collected by Lt.-Col. C. B. Philip in both Yamagata and Niigata Prefectures in 1945 from *Microtus montebelli*. It is not yet known to occur outside of Japan.

Re-description of Larvae. Shape oval. Length (engorged) to 560μ, width to 390μ. Dorsal scutum pentagonal, with PW much longer than AW, and angle of convexity of posterior margin, i.e. PW/PSB = 3·24. Sensillae long and with about 3 cilia on mid-third, only slightly posterior of line of PL. Other scutal setae long, ciliated and tapering. Eyes 2 + 2, on ocular shields, posterior eyes the smaller. Palpi stout, (fig. F), femur and genu with branched setae; tibia with ventral branched, dorsal with 1 short branch, lateral nude. Palpal claw trifurcate, Chelicerae with only the small apical tricuspid cap. Galeal setae nude. Dorsal setae long, ciliated and tapering, 34 in number, arranged 4.6.6.6.6.4.2, to 72μ long, i.e. there are 2 humeral setae on each side. Ventral setae similar but shorter, approx. 44 in number (excluding those on coxae). Legs all 7-segmented, I 325μ long, II 285μ, III 350μ (including coxae); tarsi I and II with usual dorsal sensory rod, III with 1 long nude outstanding seta to 50μ long. All coxae unisetose.

The Standard Data derived from 6 specimens from *Microtus montebelli* collected by Lt.-Col. C. B. Philip, from Yachi, Yamagata Prefecture, Japan, 28th Oct. 1945 are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	83·8±1·40	3·43±0·99	73·5–94·1	78·0–88·0	4·1
PW	100·5±3·04	7·45±2·15	78·2–122·8	94·0–115·0	7·4
SB	33·0±0·78	1·90±0·55	27·3–38·7	30·0–36·0	5·7
ASB	35·5±0·50	1·22±0·35	31·8–39·2	33·0–36·0	3·4
PSB	31·0±0·63	1·55±0·45	26·35–35·65	30·0–33·0	5·0
SD	66·5±0·92	2·56±0·65	59·7–73·3	63·0–69·0	3·4
A–P	32·5±0·50	1·22±0·35	28·8–36·2	30·0–33·0	3·8
AM	62·0±1·00	2·45±0·71	54·7–69·3	60·0–66·0	3·9
AL	58·8±1·53	3·42±1·08	48·6–69·0	54·0–63·0	5·8
PL	73·2±0·87	2·14±0·62	66·8–79·6	70·0–75·0	2·9
Sens.	88·0. Only one determination.				

TRAGARDHULA TAMIYAI (Philip and Fuller 1950.)

Trombicula tamiyai Philip and Fuller, 1950, Parasitol., Vol. 40.

Plate 1, fig. I–M.

Description of Larvae. Shape oval. Length 325μ (unfed), width 200μ. Scutum pentagonal with the posterior angle slightly rounded laterally with angle of convexity of posterior margin = 2·52. Sensillae bases posterior of line of PL; PL setae the longest; sensillae ciliated on middle two-fifths; anterior margin lightly sinuous between AL and with AM posterior of line of AL. Eyes 2 + 2, on ocular shields, about equal in size. Chelicerae with only the usual tricuspid cap. Galeal setae with 2 or 3 branches. Palpi stout, claw trifurcate; all setae on palpal femur, genu and tibia branched. Dorsal setae ca. 42, arranged 2.8.8.10.6. Ventrally with 1 seta on each coxa, a pair between coxae I and between coxae III and thereafter ca. 42. Legs: I 260μ, II 230μ, III with 3 long, nude, outstanding setae; metatarsi III with one such seta.

The Standard Data derived from 31 specimens from the original material collected by Nagayo, Tamiya and others in Yamagata, Japan, are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	64·5±0·35	1·96±0·25	58·6–70·4	60·0–69·0	3·0
PW	82·2±0·50	2·73±0·35	74·0–90·4	75·0–88·0	3·3
SB	27·25±0·27	1·48±0·19	22·8–31·7	24·0–31·7	5·3
ASB	28·25±0·37	1·48±0·19	23·8–32·7	27·0–30·0	5·2
PSB	32·6±0·30	1·66±0·21	27·6–37·6	30·0–36·0	5·1
SD	60·9±0·44	2·43±0·31	53·6–68·2	57·0–66·0	4·0
A–P	21·55±0·25	1·39±0·18	17·4–25·7	20·0–25·0	6·5
AM	44·45±0·46	2·15±0·32	38·0–50·9	42·0–48·0	4·8
AL	48·0±0·46	2·46±0·33	40·6–55·4	42·0–51·0	5·1
PL	62·45±0·50	2·65±0·35	54·5–70·4	58·0–68·0	4·2
Sens.	76·0±1·77	5·01±1·25	61·0–91·0	70·0–85·0	6·6

Remarks. This species appears to have been confused by many Japanese authors with the preceding species, *japonica* Tanaka. It is, however, as recognized by Philip and Fuller, very different in the setae of the palpal tibia, the dimensions of the scutum, the number of dorsal setae and in the number of long nude setae on leg III.

TRAGARDHULA FUJIGMO (Philip and Fuller 1950.)

Trombicula fujigmo Philip and Fuller, 1950, Parasitol., 1950.

Trombicula n. sp. "D." Lawrence in MS. 1947. In Audy 1947. "Scrub Typhus Investigations in S.E. Asia, Pt. III. Appendix 7." AMD. 7. War Office, London.

Plate 2, fig. A–C.

Description of Larvae. Shape oval. Length (unfed) 260μ width 170μ. Dorsal scutum pentagonal, but the posterior margin rather rounded, angle of convexity of posterior margin = 2·64; anterior margin sinuous with AM placed behind line of AL; sensillae about in line with PL, filamentous and ciliated on distal two-thirds. Eyes 2 + 2, close to scutum, on ocular shields, posterior slightly the smaller. Chelicerae with only the apical tricuspid cap. Galeal setae nude. Palpi stout, with all setae on femur, genu and tibia branched, except dorsal and lateral on tibia. Dorsal setae 42, arranged 2.8.8.8(10).10(8).6, to 45μ long. Ventrally with 1 seta on each coxa, a pair between coxae I and between coxae III, and thereafter 6.6.6.4.4. Legs: I 260μ long, II 220μ, III 260μ; tarsi I and II with the usual dorsal rod, III with 3 long, nude, outstanding setae on tarsi and 1 on metatarsi.

The Standard Data for 2 paratypes are: AW 60·2, PW 81·2, SB 26·6, ASB 30·8, PSB 30·8, SD 61·6 A–P 25·2, AM 42·0, AL 36·4, PL 46·2, Sens. 80·0.

Remarks. The above description is from two paratype specimens from *Crocidura vorax* from Myitkyina, Burma, April 14, 1945. Its relationship to other species is given in the key.

The single specimen, which Lawrence intended to describe, was from *Rattus r. brunneusculus* Hodgson from Kanglatongbi, nr. Imphal, Assam., Dec. 6th, 1945. This specimen was referred to by Philip and Fuller 1950 as being near to their species *fujigmo* from Burma, differing only in the somewhat higher Standard Data and the slightly greater number of dorsal setae, 47 as against 42.

Through the kindness of Dr. J. R. Audy I have been able to study this specimen and would regard it as only a slight variant of typical *fujigmo*. With

the discovery of more specimens it might be shown to be a local population. The Standard Data are: AW 75·6, PW 86·8, SB 30·8, ASB 30·8, PSB 30·8, SD 61·6, A–P 28·0, AM 56·0, AL 47·6, PL 70·0, Sens. —.

TRAGARDHULA GECKOBIA sp. n.

Plate 2, fig. D–E.

Description of Larvae. Shape oval. Colour in life unknown. Length (unfed) 230μ, width 170μ. Dorsal scutum small, pentagonal, punctate, with PW much longer than AW, and angle of convexity of posterior margin, i.e. PW/PSB = 3·8. Sensillae long, filamentous, ciliated on distal half and about in line with PL. AM scutal seta short and thin and shortly ciliated, others thicker and longer and more strongly ciliated. Eyes 2 + 2, large, on ocular shields, posterior the smaller. Chelicerae with only the apical tricuspid cap. Palpi stout; setae on femur and genu branched; on tibia, dorsal and lateral nude, ventral branched. Palpal claw bifurcate. Galeal setae stout and strongly, thickly ciliated or pectinate. Dorsal setae tapering and ciliated, 30 in number, arranged 2.8.6.6.6.2, to 30μ long. Ventral setae, excluding coxal, 2.2.8.6.4.2.2, somewhat similar but shorter than dorsal setae. Legs, all 6-segmented, femur undivided; I 200μ long, II 162μ, III 195μ; tarsi I and II with usual rod-like seta dorsally, III without any long nude seta.

The Standard Data for the type specimen are: AW 36·4, PW 53·2, SB 12·6, ASB 19·6, PSB 14·0, SD 33·6, A–P 16·8, AM 14·0, AL 25·2, PL 30·0, Sens. 42·0.

Loc. and Host. Described from the type and 3 paratypes from a gecko, collected by Dr. R. V. Southcott, 60 miles south of Darwin, N.T., Aust., 9th May, 1943.

Remarks. As the adult is unknown, this species is placed in *Tragardhula* on the bases of the pentagonal scutum. Its relation to other species is given in the key.

TRAGARDHULA PENTAGONA sp. n.

Plate 2, fig. F–I.

Description of Larvae. Shape (unfed) an elongate oval. Length (unfed) 225μ, width 150μ. Dorsal scutum pentagonal, with AM distinctly anterior of line of AL and the anterior margin strongly convex; surface sparsely punctate; with angle of convexity of posterior margin, i.e. PW/PSB = 2·44; sensillae placed only slightly behind line of PL, filamentous, with minute spicules on basal half, longer ciliations distally. Eyes 2 + 2, adjacent to postero-lateral

corners of scutum, posterior eyes the smaller. Chelicerae 24μ long, with only the small apical tricuspid cap. Galeal setae long and nude. Palpi stout; setae on palpal femur and genu long and curved with long branches; tibia with all 3 setae finely and long branched; palpal claw trifurcate; tarsus with subbasal sensory rod and 6 or 7 ciliated setae, one of which is much stronger than the others and over-reaches tip of claw. Dorsal setae 24 in number, arranged 2.6.6.4.4.2, the scapular setae 40μ long, the others 32μ, all tapering and strongly ciliated. Ventrally with a single seta on each coxa, otherwise 2.2.6.4.2.2, to 32μ long. Legs: I 240μ long, II 216μ, III 240μ; tarsi I and II with dorsal sensory rod, III without any long outstanding nude seta.

The Standard Data derived from the type and 10 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	49·2±0·44	1·79±0·33	43·85–54·55	45·0–51·0	3·6
PW	66·9±0·63	2·52±0·44	59·35–74·45	63·0–72·0	3·7
SB	19·3±0·34	1·37±0·24	15·3–23·3	18·0–21·0	7·0
ASB	27·0	No variation recorded			
PSB	27·2±0·42	1·67±0·29	22·2–32·2	24·0–30·0	6·1
SD	54·2±0·42	1·67±0·29	39·2–59·2	51·0–57·0	3·1
A–P	20·5±0·45	1·80±0·32	15·1–25·9	18·0–24·0	8·8
AM	27·0±0·68	2·33±0·48	19·4–34·6	24·0–30·0	9·4
AL	30·45±0·79	2·84±0·56	21·9–39·0	27·0–36·0	9·6
PL	33·2±0·42	1·67±0·29	27·2–38·2	30·0–36·0	5·0
Sens.	60·1±0·38	1·20±0·27	56·5–63·7	58·0–63·0	1·9

Loc. Eleven specimens collected on boots, Tolga-Atherton Road, Queensland, 2nd Sept., 1944 (R. N. McCulloch). Two other specimens, also collected on boots, Wongabel, Qld., 3rd Sept., 1944 (R.N.Mc.) and a single specimen found attached to a female *Troides priamus* (Lepidoptera-Heterocera), Atherton Tableland, Qld., 20th Aug., 1943 (R.V.S.) are also referred to this species.

This species is very close to *gymnodactyla,* Womersley and Kohls 1947, but differs in having a trifurcate palpal claw, the anterior margin of scutum strongly convex and AM in front of line of AL, as well as with the side margins of the posterior angle of scutum concave and not convex.

TRAGARDHULA GYMNODACTYLA (Wom. and Kohls, 1947).

Eutrombicula gymnodactyla Wom. and Kohls 1947, Tr. Roy. Soc. S. Aust., 71, (1), 3.

Plate 2, fig. J–M.

Description of Larvae. Shape oval. Length (engorged) to 450μ, width to 300μ. Scutum pentagonal, with its anterior margin straight or lightly sinuous between AL, and AM in line therewith; sides of posterior angle convex. Sen-

sillae ciliated on distal half with the bases nearer to each other than to PL and slightly anterior of line of PL. Eyes 2 + 2, on distinct shields, posterior eyes the smaller. Chelicerae with only the apical tricuspid cap. Galeal setae nude. Palpi stout, tibial claw bifurcate; seta on palpal femur 2–3-branched; on genu nude; on tibia only the ventral branched; tarsi short with sub-basal sensory rod and 5 or 6 ciliated setae, one of which is much stronger than the rest and over-reaches tip of tibial claw by the claw's length. Dorsal setae 28, to 30μ, long and arranged 2.8.6.6.4.2. Ventrally with a pair of branched setae on palpal segment I (gnathosoma), one on each coxa, a pair between coxae I and between coxae III, and thereafter uncertain, to 20μ long. Legs: I 210μ long, II 195μ, III 210μ; tarsi I and II with usual dorsal sensory rod; tarsi III without any long nude seta.

The Standard Data for the type and 3 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	45·75±0·75	1·50±0·50	41·25–50·25	45·0–48·0	3·2
PW	60·0	No variation recorded			
SB	16·5±0·87	1·73±0·61	11·3–21·7	15·0–18·0	10·5
ASB	18·0	No variation recorded			
PSB	23·25±0·75	1·50±0·53	18·75–23·75	21·0–24·0	6·4
SD	41·25±0·75	1·50±0·53	36·75–45·75	39·0–42·0	3·6
A–P	19·5±0·87	1·73±0·61	14·3–24·7	18·0–21·0	8·8
AM	24·0	No variation recorded			
AL	25·5±0·87	1·73±0·61	20·3–30·7	24·0–27·0	6·8
PL	24·0	No variation recorded			
Sens.	47·0±1·0	1·73±0·71	41·8–52·2	45·0–48·0	3·7

Remarks. This species was described from a gecko *Gymnodactylus louisiadensis* from Sansapore, Dutch New Guinea. It is very close to the preceding new species, *pentagona,* but differs in the palpal setae and bifurcate palpal claw and in the shape of the dorsal scutum.

To it are now referred 5 specimens in the South Australian Museum, collected from *Phyllodactylus marmoratus* (a gecko) on Greenly Island, S. Aust., Dec. 1947 (F. J. Mitchell), and 4 specimens from a gecko, approximately 60 miles south of Darwin, Northern Territory of Australia, May 9, 1943 (R.V.S.). The DS are actually 2.8.6.6.4.2, not 2.6.6.4.4.2 as originally given.

Genus TROMBICULA Berlese 1905.

Berlese 1905. *Acari nuovi* Manip. IV, 155, taf. XV, fig. 4; *idem,* 1912, "Redia," 8, fasc. *1,* p. 83, fig. 39–44.

Genotype *Trombicula minor* Berl. 1905, Adult from Java.

= *Eutrombicula* Ewing 1938, J. Washington Acad. Sci., 27, 293.

= *Acariscus* Ewing 1943, Proc. Ent. Soc. Washington, 45, (3).

The unjustified separation of *Acariscus* from *Eutrombicula* on the number of dorsal setae has been pointed out by Michener (1946, Ann. Ent. Soc. America, 39, 432). Earlier in the same year and publication, p. 411–417, Michener described the nymphs of three American species of *Eutrombicula*, all of which were found to have one eye on each side, closely adjacent to the sensillary area, as in the genotype of *Trombicula* (*T. minor* Berl.) and as is also the case in *T. samboni* Wom. from S. Australia, and *T. wichmanni* from New Guinea, etc. It seems probable, therefore, that at least the abovementioned species, in which the palpal claws of the larvae are bifurcate, will when the larvae of the genotype are known be correctly placed in the genus *Trombicula* s. str. as defined on adult and/or nymphal characters.

Key to the Subgenera and Species of TROMBICULA S. Str. from the Asiatic-Pacific Region.

N.B.—Where the adults and/or nymphs are known and correlated with the larvae the subgenus as based on adult and/or nymphal characters is given in parenthesis, but where this is assumed on the homology of larval characters the subgeneric name is preceded by a question mark; otherwise no subgenus is as yet to be suggested.

1. Galeal setae branched or ciliated. Setae on palpal femur and genu nude; on tibia, dorsal ciliated or branched. Palpal claw bi- or trifurcate. Scutum wider than long, more or less rectangular. Scutal and dorsal setae normal, ciliated or with strong denticles, not lanceolate with folded edges or otherwise modified. (Adults and nymphs where known with precoxal plates on leg I, forming a longitudinally divided sternum. Eyes absent) 2

   Subgen. *Leptotrombidium* Nagayo *et al.*, 1916. = "*akamushi*" group of Wharton 1947

   Without the above combination of characters 19

2. Postero-lateral corners of scutum well rounded, with PL placed about midway between AL and the posterior scutal margin 3

   PL placed at the more or less angular postero-lateral scutal corners . 8

3. Ventral setae of palpal tibia branched. Seta of coxae III on anterior margin. DS 44–50, in number arranged 2.10(12).10(12).10.6(8).4.2, fairly thick with strong lateral setules.

   AW 65·5±7·0 PW 70·3±7·4, SB 29·8±4·1, ASB 24·0, PSB 15·0, SD 39·0, A–P 18·5±3·8, AM 46·4±6·7, AL 36·5±5·1, PL 58·1±7·2, Sens. 67·0±8·2.

   Trombicula (?*L.*) *palpalis* (Nagayo *et al.* 1919).

   Ventral setae of palpal tibia nude 4

4. Dorsal setae 50 or more in number 5

   Dorsal setae fewer than 40 in number 6

5. Dorsal setae 52 in number, arranged ca. 2.12.4.10.4.8.8.4, to 45μ long, slender and tapering with ciliations rather than setules. Sensillae proximally nude.

   AW 58·8, PW 68·6±4·6, SB 28·9±3·4, ASB 27·1±4·3, PSB 11·2, SB 38·3±4·3, A–P 23·3±4·3, AM 51·5±9·6, AL 44·8 ±5·9, PL 54·9±4·6, Sens. 61·6±6·8.

   Trombicula (? *L.*) *kuekenschrijveri* (Walch 1923).

   Dorsal setae ca. 70 in number, to 43μ long, thick and strongly setulate or dentate, arranged 2.12.14.12.10.8.6.4.2. Sensillae proximally barbed.

   AW 70·5±5·1, PW 76·75±9·6, SB 35·6±5·5, ASB 26·7± 2·7, PSB 14·8±1·8, SD 41·5±3·0, A–P 19·0±3·8, AM 49·8±5·6, AL 42·15±5·2, PL 53·3±7·0, Sens. 71·5±7·2.

   Trombicula (? *L.*) *pallida* (Nagayo *et al.* 1919).

6. Dorsal setae 38–40 in number, to 58μ long, arranged ca. 2.10.8.8.6.4.2(0), with setules or dentations which are not as long as in *pallida*. Sensillae proximally minutely barbed.

   AW 53·8, PW 63·0, SB 25·8, ASB 24·8, PSB 12·9, SD 37·7, A–P 17·2, AM 51·6, AL 38·7, PL 58·1, Sens. 66·7, (Womersley and Heaslip 1943, after Nagayo *et al.*, 1921.)

   AW 69·2±5·0, PW 77·8±2·7, SB 33·7±0·8, ASB —, PSB 13·3±1·6, SD —, A–P 23·5±2·8, AM 49·8±2·3, AL 39·3±9·1, PL 54·8±4·0, Sens. 61·5±12·1 (after Kuwata, Berge and Philip 1950). *Trombicula* (? *L.*) *intermedia* (Nagayo *et al.* 1920).

   Dorsal setae 28–30 in number 7

7. Scutum smaller, with PW only slightly greater than AW. Setae on palpal genu very long and over-reaching palpal claw. DS 30 in number, arranged 2.8.6.6.2.6, to 50μ long, sparsely barbed. Sensillae ciliated on distal two-thirds, minutely barbed on basal third.

   AW 50·5, 51·5, PW 52·0, 53·0, SB 24·0, 24·5, ASB ca. 20·0, PSB 11·0, SD ca. 31·0, A–P 14·0, 15·0, AM 29·5, 32·5, AL 28·5, PL 49·5, 51·0, Sens. 40·5, 42·0 (after Kuwata, Berge and Philip 1950, except ASB and SD, which are interpolated from their figure). *Trombicula* (? *L.*) *fuji* (Kuwata, Berge and Philip 1950).

   Scutum larger with PW distinctly greater than AW. Palpal genual setae shorter. DS 28, to 58μ long, arranged 2.8.6.6.4.2, thicker and strongly dentate.

   AW 58·5±8·9, PW 69·4±7·0, SB 31·1±4·8, ASB 28·0, PSB 11·2, SD 39·2, A–P 20·85±4·4, AM 40·8±6·6, AL 50·4±8·4, PL 56·0±4·2, Sens. 68·3±7·5.

   Trombicula (? *L.*) *lanceolata* sp. n. Lawrence in MS.

8. Palpal claw trifurcate 9

   Palpal claw bifurcate 15

9. Ventral seta of palpal tibia branched 10

   Ventral seta of palpal tibia nude 12

10. Dorsal setae 52 in number, arranged ca. 2.13.12.12.8.4.2, to 56μ long, tapering with strong long ciliations rather than denticles.

AW 70·1±6·3, PW 86·8±9·2, SB 35·5±4·4, ASB 30·8, PSB 14·0, SD 44·8, A–P 25·2, AM 63·8±3·7, AL 48·5±4·3, PL 63·8 ±3·7, Sens. 85·4. *Trombicula* (? *L.*) *parapalpalis* sp. n.

Dorsal setae stout, not tapering, with strong denticles 11

11. With only 1 humeral seta on each side of first dorsal row. Dorsal setae ca. 42 in number, to 40μ long and arranged ca. 2.10.8.10.6.4.2.

AW 64·4, PW 75·6, SB 30·8, ASB 28·0, PSB 11·2, SD 39·2, A–P 25·2, AM 47·5, AL 40·0, PL 50·4, Sens. 61·6.
Trombicula (? *L.*) *macacus* sp. n. Lawrence in MS.

With 2 humeral setae on each side in first dorsal row. Dorsal setae ca. 52 in number, arranged 4.10.8.2.8.8.6.2.2, to 40μ long.

AW 75·6, PW 81·2, SB 36·4, ASB 28·0, PSB 15·4, SD 43·4, A–P 25·2, AM 42·0, AL 33·6, PL 42·0, Sens. —.
Trombicula (? *L.*) *puta* sp. n.

12. Scutum very large, with irregularly wrinkled or shagreened surface. Dorsal setae ca. 80–90 in number, to 50μ long, tapering and strongly ciliated.

AW 99·2, PW 121·6, SB 51·2, ASB 41·6, PSB 16·0, SD 57·6, A–P 33·2, AM 62·4, AL 56·0, PL 70·4, Sens. 96·0.
Trombicula (? *L.*) *dux* sp. n.

Scutum smaller, surface punctate. Dorsal setae ca. 50 or fewer in number 13

13. Dorsal setae ca. 50 in number, arranged ca. 2.10.10(12).10(8).8.6.4, to 51μ long, more or less tapering and fairly thick with strong ciliations.

AW 72·4±6·1, PW 82·2±10·4, SB 32·2±5·9, ASB 29·1±5·5, PSB 15·1±1·2, SD 44·0±5·7, A–P 28·3±5·8, AM 59·8±4·6, AL 50·6±10·8, PL 64·3±7·3, Sens. 77·75±5·75.
Trombicula (? *L.*) *scutellaris* (Nagayo *et al.* 1920).

Dorsal setae fewer in number 14

14. Dorsal setae 28 in number, arranged 2.8.6.6.4.2, with very little variation. Sensillae bases in line with or only slightly in advance of line of PL. Posterior scutal margin more rounded and ca. 12μ behind PL. (For populations, see text).

Trombicula (*L.*) *deliensis* (Walch 1923)
= *vanderghinstei* Gunther 1940.
= *walchi* Wom. and Heasp. 1943.

Dorsal setae more variable from 34 to 40 in number, generally 38, and mostly arranged 2.10(8).8.8.6.4.2(0). Sensillae bases distinctly in front of line of PL. (For ranges of Standard Data in various populations, see text). *Trombicula* (*L.*) *akamushi* Brumpt 1910.
= *fletcheri* Wom. and Heasp. 1943.
= *obscura* Wom. 1944.

15. Dorsal setae very numerous, more than 100 in number, in ca. 10 rows of 14 each, to 58μ long, slender, tapering and strongly ciliated.

AW 88·5±7·5, PW 103·0±10·8, SB 41·2±3·7, ASB 35·8±3·7, PSB 13·4±3·7, SD 49·3±7·5, A–P 34·7±4·6, AM 75·6±6·0, AL 62·2±3·7, PL 72·0±7·0, Sens. —. *Trombicula* (*? L.*) *villosa* sp. n.

Dorsal setae much fewer in number 16

16. Dorsal setae ca. 42 in number, to 70μ long anteriorly and arranged 2.12.8.8.6.4.2.

AW 83·2±4·2, PW 93·8±4·8, SB 36·4±6·8, ASB 35·0±4·8, PSB 16·1±4·2, SD 51·1±8·0, A–P 28·7±8·0, AM 51·3±12·8, AL 47·6, PL 58·1±8·0, Sens. 78·4.

Trombicula (*? L.*) *tithwalensis* sp. n.

Dorsal setae 28–32 in number 17

17. Dorsal setae 32 in number, arranged 2.10.8.6.4.2, to 54μ long, tapering and slender, and ciliated. Ventral seta on palpal tibia branched. Anterior and posterior margins of scutum strongly sinuous.

AW 70·4, PW 83·2, SB 35·2, ASB 30·0, PSB 12·6, SD 42·6, A–P 28·8, AM 32·0, AL 41·6, PL 48·0, Sens. —.

Trombicula (*? L.*) *bhimtalensis* sp. n.

Dorsal setae 28, arranged 2.8.6.6.4.2 18

18. PL scutal setae very long, and more than twice as long as AL or PW. Posterior scutal margin a shallow even curve, with SB behind line of PL.

AW 59·9±5·9, PW 71·5±6·9, SB 26·75±4·7, ASB 32·0, PSB 9·6, SD 41·6, A–P 25·6, AM 55·5±11·0, AL 55·1±6·7, PL 108·3±24·0, Sens. 69·8±3·7. *Trombicula* (*L.*) *longiseta* sp. n.

PL not much, if at all longer than PW. Posterior scutal margin strongly sinuous and concave medially. SB only slightly behind line of PL. *Trombicula* (*L.*) *fulleri* (Ewing, 1945).

19. PL and dorsal setae lanceolate or foliate with folded edges carrying a double row of setules. Palpal claw bi- or trifurcate. Setae on palpal femur and genu nude; on tibia lateral and ventral nude, dorsal ciliated or branched. Scutum rectangular with rounded posterior corners and PL midway between AL and posterior margin .. 20

PL and dorsal setae normal, or otherwise than as above 21

20. Scutum larger. Palpal claw bifurcate. Dorsal setae 48 in number, to 42μ long and arranged ca. 2.10.8.8.8.6.4.2.

AW 75·0±9·7, PW 84·3±10·7, SB 37·3±6·3, ASB 30·4±4·2, PSB 16·0, SD 46·4±4·8, A–P 19·55±6·25, AM 44·8±9·6, AL 43·6±5·0, PL 48·9±7·2, Sens. 60·8 (57·6, 64·0).

Trombicula (*Neotrombicula*) *fordi* sp. n. Lawrence in MS.

Scutum smaller. Palpal claw trifurcate. Dorsal setae 52 in number, to 30μ long and arranged ca. 2.10.10.10.8.6.2.

AW 64·4, PW 75·6, SB 33·6, ASB 28·0, PSB 15·4, SD 43·4, A–P 22·4, AM 42·0, AL 39·2, PL 36·4, Sens. 60·0.

Trombicula (*? N.*) *traubi* sp. n.

21. Dorsal and AM and PL scutal setae lanceolate, finely ciliated and without folded edges. Palpal claw trifurcate. Dorsal setae 30 in number, 34–42μ long and arranged ca. 2.8.6.6.4.4.

AW 67·2, PW 72·8, SB 36·4, ASB 30·6, PSB 14·0, SD 44·8, A–P 14·0, AM 30·8, AL 30·8, PL 58·8, Sens. 70·0.

Trombicula (*N.*) *hastata* (Gater 1932).

Dorsal and scutal setae normal, more or less tapering with fine ciliations, or phyllode-like, or broad and aciculate 22

22. Galeal setae nude 23

Galeal setae ciliated or branched 63

23. Tarsi III with 2, metatarsi III with 1 long nude seta. All 3 setae on palpal tibia and the setae on femur and genu nude. Palpal claw trifurcate. Dorsal setae 26 in number, arranged 2.6.6.6.4.2, and from 50μ to 89μ long. Scutum with posterior margin an even curve, deep behind PL. SB in line with PL and in midline of scutum.

AW 70·65±7·45, PW 93·9±9·0, SB 30·3±5·6, ASB 36·15±3·05, PSB 26·65±3·6, SD 62·65±5·45, A–P 33·6±6·75, AM 55·2±9·0, AL 50·4±5·55, PL 66·85±14·05, Sens. 95·8±9·4.

Trombicula novae-hollandiae Hirst 1929.

Tarsi III only with one long nude seta or without 24

24. Palpal claw bifurcate 25

Palpal claw trifurcate 50

25. Tarsi III with a long nude outstanding seta sub-basally 26

Tarsi III without such, or if present then ciliated 38

26. Scutum more or less quadrate with SB wide apart and close to AL. DS 22 in number, arranged 2.6.6.4.2.2, variable in length in different populations from 31μ to 56μ.

AW 87·6±6·9, PW 94·8±8·0, SB 59·0±5·3, ASB 21·4±6·2, PSB 53·0±7·1, SD 74·4±6·3, A–P 41·7±7·2, AM 43·9±9·7, AL 38·0±5·6, PL 55·0±9·0, Sens. 58·65±10·45.

Trombicula (*N.*) *rara* (Walch 1923).

Scutum more rectangular with SB not placed as above 27

27. Dorsal setae 20(22) arranged 2.6.6.4.2(2) 28

Dorsal setae 26 or more 31

28. Posterior scutal margin relatively deep, its greatest distance from line of PL more than twice that between line of SB and PL 29

Posterior scutal margins shallower, its greatest distance from line of PL equal to or less than that between SB and PL 30

29. Ratio of PW/SD = 1·35 — 1·52. Seta on palpal femur 3–5-branched; on genu usually 1-, occasionally 2-branched; on tibia, dorsal and lateral nude, ventral 3–4-branched. DS 20 in number, to 55μ long. *Trombicula* (*? Trombicula*) *hirsti* Sambon 1927.

AW 83·5±7·3, PW 96·6±7·9, SB 42·8±4·6, ASB 29·2±2·6, PSB 38·6±5·6, SD 65·4±6·3, A–P 35·9±3·7, AM 40·6±7·0, AL 45·95±7·1, PL 54·15±4·7, Sens. 64·9±5·4.

f. typ. hirsti Sambon 1927.

AW 84·5±9·4, PW 99·35±9·7, SB 44·35±4·8, ASB 26·7±4·6, PSB 38·45±5·2, SD 56·4±5·8, A–P 34·6±5·9, AM 47·1±8·2, AL 53·1±8·3, PL 57·7±8·9, Sens. 58·95±11·2.

f. deliensis (Walch 1923).
= *buloloensis* Gunther 1939.

AW 95·0, PW 110·0, SB 43·0, ASB 33·0, PSB 48·0, SD 81·0, A–P 39·0, AM 58·0, AL 55·0, PL 70·0, Sens. 70·0.

f. hakei Radford 1946.

AW 109·7±8·6, PW 125·7±13·4, SB 58·7±7·1, ASB 32·0, PSB 43·0, SD 75·0, A–P 43·0, AM 53·9±5·6, AL 61·2±9·5, PL 65·9±13·6, Sens. 60·0±6·7. *f. nissanensis* Dumbleton 1947.

Ratio of PW/SD ca. 1·86. Seta on palpal tibia with 2–3 short branches, often appearing nude; on genu nude; on tibia dorsal and lateral nude, ventral branched. DS 20 in number, to 50μ long.

Trombicula (*? T.*) *sobrina* sp. n.

30. Setae on palpal femur, genu and tibia (except ventral) nude. Scutum irregularly punctate, not striate-punctate. DS 22 in number, to 35μ long.

AW 73·25±4·5, PW 90·2±7·5, SB 36·0±3·4, ASB 21·0, PSB 31·0±3·0, SD 52·0±3·4, A–P 29·0±2·0, AL 24·5±3·0, PL 32·5±3·0, Sens. ?. *Trombicula* (*? T.*) *ablephara* sp. n.

Setae on palpal femur 3–5 branched; on genu nude; on tibia dorsal and lateral nude, ventral 3–4-branched. Scutum striate-punctate. DS 22 to 35μ. (For Standard Data of different populations see Table C).

Trombicula (*T.*) *wichmanni* (Ouds. 1905).

31. Dorsal setae fewer than 40 in number 32

Dorsal setae more than 40 in number 36

32. Dorsal setae 26(28) in number 34

Dorsal setae 32 to 38 in number 33

33. Dorsal scutum larger with posterior margin deeper behind PL. AM the shortest. DS 32 in number, arranged 2.8.8.6.4.2.2. to 75·0μ long.

AW 103·0, PW 118·0, SB 44·0, ASB 36·0, PSB 23·0, SD 59·0, A–P 32·0, AM 43·0, AL 69·0, PL 85·0, Sens. 90·0.

Trombicula anous (Wharton 1946).

Dorsal scutum smaller, with posterior margin shallower behind PL. AL the shortest. DS 38 in number, arranged 2.10.8.8.4.4.2, to 65·0μ. long.

AW 86·0, PW 90·0, SB 36·0, ASB 29·0, PSB 16·0, SD 45·0, A–P 30·0, AM 50·0, AL 40·0, PL 72·0, Sens. 60·0.

Trombicula pluvius (Wharton 1946).

34. Setae on palpal femur, genu and tibia all nude. DS 26–28 in number, to 55μ long, and arranged 2.6(8).6.6.4.2. Scutum irregularly punctate.

AW 102·7±6·9, PW 123·0±6·0, SB 47·6±4·9, ASB 29·0, PSB 37·1±5·3, SD 65·9±5·3, A–P 33·9±4·4, AM 38·3±6·2, AL 47·7±5·9, PL 53·1±5·9, Sens. 64·0. *Trombicula lygosomoides* sp. n.

Seta on palpal femur branched or ciliated 35

35. Dorsal setae 26, uniformly arranged 2.6.6.6.4.2, to 39μ long. Seta of palpal femur 4–5-branched; of genu 1–2-branched; of tibia dorsal and lateral nude, ventral 3–4-branched.

AW 87·8±1·7, PW 97·7±12·5, SB 39·7±6·7, ASB 39·0±5·9, PSB 29·2±4·3, SD 68·2±8·4, A–P 31·6±4·1, AM 40·3±3·5, AL 45·2±6·2, PL 52·1±5·2, Sens. 72·2±9·9.

Trombicula (*T.*) *samboni* Wom. 1939.

Dorsal setae 28, arranged 2.6.6.2 then two lateral clusters of 6 + 6. Seta of palpal femur 4–5-branched; of genu 1–2-branched; of tibia dorsal and lateral nude, ventral 3–4-branched.

AW 83·3±6·5, PW 92·4±10·4, SB 40·0, ASB 27·0, PSB 34·9± 3·3, SD 62·0±4·0, A–P 33·5±3·4, AM 31·5±6·4, AL 40·1± 4·4, PL 46·1±7·4, Sens. 64·3±2·2.

Trombicula (*N.*) *sarcina* (Wom. 1944).

36. With 3 humeral setae on each side. Dorsal setae ca. 6.10.2.8.2.10.8.-4.2, to 42μ long. Telofemur of leg I with 2 very long outstanding ciliated setae, of legs II and III with 1 such.

AW 70·0, 75·6, PW 89·6, 95·2, SB 30·8, 33·6, ASB 28·0, 28·0, PSB 28·0, 28·0, SD 56·0, 56·0, A–P 25·2, 25·2, AM 42·0, 42·0, AL 42·0, 42·0, PL 56·0, 56·0, Sens. 70·0, 70·0.

Trombicula kanzalwanensis sp. n.

With only 1 humeral seta on each side 37

37. Dorsal setae 44 in number, arranged 2.6.6.10.8.6.4.2, the posterior five rows clustered together. Palpal femur with seta with 6 or more short branches; genu with nude seta; tibia with dorsal and lateral nude, ventral with 3–4 branches.

AW 83·4±6·9, PW 89·9±4·9, SB 36·0±4·2, ASB 27·0±4·2, PSB 34·2±3·3, SD 61·2±6·0, A–P 31·6±2·7, AM 35·7±3·5, AL 40·0, PL 54·0±3·3, Sens. 72·0.

Trombicula (*? T.*) *macropus* Wom. 1936.

Dorsal setae 68 in number, arranged 2.14.12.4.6.8.10.8.4, somewhat clustered posteriorly. Seta on palpal femur with many short branches or ciliations; on genu nude; on tibia dorsal and lateral nude, ventral 3–4-branched.

AW 100·8±6·5, PW 111·2±6·5, SB 55·4±5·6, ASB 29·2±3·3, PSB 34·4±4·0, SD 63·6±7·2, A–P 31·6±3·4, AM 59·8±3·3, AL 68·8±8·3, PL 72·0±6·3, Sens. 70·7±8·9.

Trombicula (*? T.*) *rioi* Gunther 1939.

38. AL scutal setae short and peg-like (genus *Fonsecia* Radford 1942). All setae on palpal femur, genu and tibia (except ventral) nude. DS 30 in number, stiff, with indistinct barbs, to 60μ long and arranged 2.6.6.6.4.4.2.

AW 90·0, PW 108·0, SB 32·0, ASB 21·0, PSB 30·0, SD 51·0, A–P 32·0, AM 60·0, AL 14·0, PL 36·0, Sens. 70·0.

Trombicula coluberina (Radford 1946).
(= *Fonsecia coluberina* Radford 1946).

AL scutal setae normal 39

39. Scutum smaller, with AW less than 60μ 40

Scutum larger, AW often very much more than 60μ 42

40. Sensillae with only a single branch, half its entire length. Seta on palpal femur with 2–4 short branches; genu with 1 branch; tibia with all 3 nude. DS 38, arranged 2.8.8.6.6.4.4, to 25μ long.

AW 39·8±12·2, PW 48·2±12·7, SB 18·6±6·6, ASB ?, PSB 19·6±5·4, SD ?, A–P 24·7±4·9, AM 27·4±2·7, AL 23·2±4·9, PL 30·0±14·1, Sens. 39·6±8·1, (after Philip and Traub 1950).

Trombicula batui Philip and Traub 1950.

Sensillae otherwise 41

41. Sensillae with only 2–3 short branches or ciliations on distal half. DS 24 in number, arranged 2.6.6.4.4.2, to 25μ long. Setae on palpal femur and genu nude; on tibia, dorsal with 1 or 2 short indistinct barbs, lateral and ventral nude.

AW 33·0, PW 47·0, SB 12·5, ASB 16·8, PSB 17·0, SD 33·8, A–P 17·0, AM 21·0, AL 20·0, PL 30·0, Sens. 30·0.

Trombicula (*N.*) *munda* (Gater 1932).

Sensillae with numerous branches or ciliations distally. DS 26 in number, arranged 2.6.4.4.4.4.2, to 35·0μ long. Seta on palpal femur with a few short branches; on genu nude; on tibia dorsal with 1 or 2 short branches, lateral and ventral nude.

AW 38·0, PW 51·0, SB 13·0, ASB 18·0, PSB 22·0, SD 40·0, A–P 20·0, AM 23·0, AL 25·0, PL 30·0, Sens. 38·0.

Trombicula (*N.*) *spicea* (Gater 1932).

Sensillae slightly thickening apically, with numerous ciliations. Dorsal setae 36 in number to 46μ long and arranged ca. 2.8.6.8.4.2. Only ventral seta on tibia of palpi branched.

AW 53·6–60·3, PW 80·4, SB 30·15, ASB 23·45, PSB 10·05–13·4, SD 33·5–36·85, A–P 20·1, AM 43·55, AL 33·5–36·85, PL 60·3–63·65, Sens. 53·6. *Trombicula* (*N.*) *consueta* sp. n.

42. Palpi with femur and genu cylindrical, tibia very small, with the claws represented by two short stumpy prongs which are shorter than tarsus. Dorsal setae 20 in number, arranged 2.6.6.4.2, from 50μ to 40μ long. Scutum shield-like.

AW 63·0±4·7, PW 73·25±4·45, SB 36·7±2·5, ASB 22·4, PSB 38·3±5·0, SD 60·7±5·0, A–P 29·75±4·05, AM 45·6±6·5, AL 31·85±7·45, PL 49·5±6·5, Sens. 53·7±6·7.

Trombicula parmifera sp. n.

Palpi and palpal claw normal 43

43. Scutum conspicuously striate-punctate, and large 48

Scutum smaller and not striate-punctate 44

44. Setae on palpal femur and genu nude. All setae on palpal tibia nude. DS 22, arranged 2.6.6.4.2.2, to 36μ, fine with only indistinct ciliations. Setae on palpal femur and genu branched 45

All setae on palpal tibia nude. DS 22, arranged 2.6.6.4.2.2, to 36μ, fine with only indistinct ciliations.

AW 78·85±7·8, PW 85·4±9·0, SB 44·1±5·2, ASB 21·0, PSB 37·8±5·3, SD 58·8±5·3, A–P 29·4±3·6, AM 24·1±6·4, AL 22·0±5·5, PL 22·55±7·8, Sens. 50·0. *Trombicula lundbladi* sp. n.

45. Scutum rectangular, much wider than long, with AW not much shorter than PW, shallow behind PL, and with anterior and posterior margins almost rectilinear. Sensillae rather thick with ciliations on distal two-thirds, bases nearer to one another than to lateral margin and in front of line of PL. Setae on palpal femur and genu branched, on tibia all three nude. Dorsal setae 28 in number, to 55μ long, and arranged 2.8.6.6.4.2.

AW 66·0, PW 69·0, SB 23·0, ASB 26·0, PSB 13·0, SD 39·0, A–P 29·0, AM 26·0, AL 33·0–36·0 (34·5), PL 43·0–46·0 (44·5), Sens. 36·0 (after Dumbleton). *Trombicula nissani* Dumbleton 1947.

Scutum not as above 46

46. Scutum much wider than long, but with AW much shorter than PW, and the lateral margins diverging widely posteriorly; anterior and posterior margins almost rectilinear. Dorsal setae ca. 38 in number, to 30μ long and arranged 2.8.6.6.6.6.4.

AW 56·0, PW 86·8, SB 44·6, ASB 28·0, PSB 12·0, SD 40·0, A–P 50·4, AM 25·2, AL 22·4, PL 50·4, Sens. —.

Trombicula jubbulporensis sp. n.

Scutum not much wider than long, with AW only a little less than PW 47

47. Scutum with posterior margin deep and rounded behind line of PL; anterior margin convex with AM slightly in front of AL; sensillae bases nearer to lateral margins than to each other and in front slightly of line of PL. Setae on palpal femur and genu, and the ventral on tibia branched. Dorsal setae 26 in number, to 56·0μ long, and arranged 2.6.6.6.4.2.

AW 72·0, PW 78·0, SB 31·0, ASB 27·0, PSB 28·0, SD 55·0, A–P 28·0, AM 58·0, AL 43·0, PL 74·0–78·0, Sens. 97·0 (after Sugimoto). *Trombicula isshikii* Sugimoto 1938.

Scutum with the posterior margin angular, giving a pentagonal form; depth of posterior margin less than distance between SB and line of PL. AL setae placed rather well back from the rounded antero-lateral shoulders and behind AM. All setae on palpal femur, genu and tibia branched. Dorsal setae 44 in number, to 38μ long, and arranged 2.4.6.6.4.6.6.4.4.2. Coxae III 1-setose.

AW 61·6, PW 73·0, SB 22·4, ASB 28·0, PSB 28·0, SD 56·0, A–P 30·0, AM 36·4, AL 30·8, PL 47·6, Sens. 64·4.
Trombicula khurdangensis sp. n.

48. Scutum fairly large with AW 97·0–122·0, and PW 112·0–132·0.

AW 98·2±5·6, PW 113·5±6·5, SB 51·05±3·65, ASB 28·0± 3·4, PSB 26·6±4·2, SD 54·6±5·8, A–P 30·4±4·7, AM 39·9± 5·2, AL 39·2±3·4, PL 47·6±3·4, Sens. 57·4±6·7.
Trombicula (*N.*) *scincoides* (Wom. 1944). *f. typica.*

AW 105·4±8·8, PW 116·7±13·0, SB 55·1±5·7, ASB 30·8± 4·5, PSB 28·0, SD 58·8±4·5, A–P 32·8±4·1, AM 46·95±4·15, AL 44·0±4·8, PL 51·3±4·9, Sens. 64·4±70·0.
Trombicula (*N.*) *scincoides* (Wom. 1944) *f.* ex Hollandia.

Scutum larger or smaller than above 49

49. Scutum larger than above.

AW 110·8±8·2, PW 124·4±0·56, SB 62·4±6·3, ASB 34·8± 4·5, PSB 33·6, SD 68·4±4·5, A–P 36·8±3·2, AM 45·6±4·1, AL 47·6±4·8, PL 55·6±3·2, Sens. 63·6±4·1.
Trombicula (? *N.*) *kohlsi* (Wom. 1944).

Scutum smaller than above.

AW 77·9±3·4, PW 89·1±8·2, SB 40·1±6·85, ASB 27·1±4·3, PSB 25·7±3·4, SD 52·7±3·4, A–P 26·1±4·3, AM 29·4±4·6, AL 30·8, PL 41·5±3·4, Sens. 56·0. (For other populations see text.)
Trombicula (? *N.*) *tovelli* sp. n.

50. A long nude seta on tarsi III 51

No long nude seta on tarsi III 53

51. Scutum small; shield-shaped; with anterior margin deeply concave, and posterior margin forming a shallow angle. Sensillae ciliated their whole length and SB in front of PL. AL well back from shoulders and behind AM. All setae on palpal femur, genu and tibia nude. Coxae III bisetose. DS thick and strongly ciliated, to 48μ long and arranged 2.6.6(4).4(6).4.2.2.

AW 45·3±6·6, PW 46·6±5·1, SB 18·7±2·3, ASB 28·8, PSB 22·4, SD 51·2, A–P 25·6, AM 38·4, AL 22·4, PL 41·6, Sens. 54·7±7·1.
Trombicula buxtoni sp. n.

Scutum larger, not shield-shaped, more or less rectangular, or with deeply curved posterior margin 52

52. Posterior scutal margin a deep curve behind line of PL with PL nearer to AL than to posterior margin, and SB behind line of PL. All setae on palpal femur, genu and tibia fine and nude. DS 22 in number, to 50μ long, and arranged 2.8.6.4.2.

AW 81·0–82·0 (81·5), PW 90·0–91·0 (90·5), SB 36·0–40·0 (38·0), ASB 26·0–30·0 (28·0), PSB 20·0, SD 46·0–50·0 (48·0), A–P 16·0, AM ?, AL 23·0–26·0 (24·5), PL 49·0, Sens. 69·0 (after Dumbleton). *Trombicula naultini* Dumbleton 1947.

Posterior scutal margin not so rounded except laterally, medially rather flattened. PL nearer to posterior than to anterior margins and SB in front of PL. All setae on palpal femur, genu and tibia (except ventral) nude. DS 32 in number, to 40μ and arranged ca. 2.6.6.6.6.4.2.

AW 65·2–72·0 (67·5), PW 68·5–81·5 (73·9), SB 26·0–32·6 (28·2), ASB 23·4, PSB 23·4, SD 46·8, A–P 26·0–32·6, AM 39·1–45·6 (42·2), AL 39·1–45·6 (41·3), PL 42·5–65·2 (49·9), Sens. 65·0–81·5 (72·8). *Trombicula cervulicola* Ewing 1931.

53. With more than 50 dorsal setae 54

With fewer than 50 dorsal setae 56

54. Dorsal setae 68–70 in number 55

Dorsal setae 58 in number, to 50μ long and arranged 2.8.8.12.12.6.4.4.2. Scutum rectangular between PL, and with SB very much nearer to line of PL than to line of AL. Seta on palpal femur branched. (Galeal setae stated by Walch to be 1-branched).

AW 69·0 (72·0), PW 75·0 (80·0), SB 24·0 (22·0), ASB 27·0 (28·2), PSB 10·0 (11·0), SD 37·0 (39·2), A–P 30·0 (37·0), AM 42·0 (37·0), AL 45·0 (51·0), PL 62·0 (51·0), Sens. 50·0 (45·0). (The values in parentheses after Walch.)

Trombicula densipiliata Walch 1923.

55. Sensillae ciliated distally, with bases fairly close together. Anterior and posterior scutal margins strongly sinuate. Dorsal setae ca. 70 in number, to 30μ long, arranged approximately 2.10.10.10.10.10.8.6.4.

AW 64·4, PW 87·0, SB 19·6, ASB 33·6, PSB 14·0, SD 47·6, A–P 39·2, AM 20·0+, AL 40·0, PL 59·4, Sens. 56·0.

Trombicula taphozous sp. n.

Sensillae only ciliated basally, wide apart and in front of line of PL. Setae on palpal femur and genu strongly branched, on tibia all 3 nude. Anterior and posterior scutal margins at most lightly sinuate. Dorsal setae 68 in number, to 45μ long and arranged 2.10.10.16.12.10.8.

PW 85·0, SD 47·0, Sens. 58·0, PW/SD = 2·3 (after Kaw. and Yam. 1921). *Trombicula corvi* Kawamura and Yamaguchi 1921.

56. Scutum with posterior margin almost rectilinear between PL 57

Posterior margin of scutum not rectilinear but deep behind line of PL 58

57. Scutum trapezoidal with AW much less than PW. Sensillae bases nearer to line of PL; at about three-quarters of scutal depth. Setae of palpal femur, genu and tibia all nude. DS ca. 42 in number, to 45μ long and arranged 2.8(9).8(10).8 plus about 20.

AW 48·0–52·0 (50·0), PW 65·0–69·0 (66·3), SB 22·0–23·0 (22·7), ASB ca. 33·0, PSB 11·0–12·0 (11·7), SD ca. 44·0, A–P 35·0–36·0 (35·2), AM 44·0–46·0 (45·0), AL 42·0, PL 57·0–64·0 (60·3), Sens. 65·0–68·0 (66·5). (After Philip and Traub 1950).

Trombicula insolli Philip and Traub 1950.

Scutum almost rectangular, with AW only slightly less than PW. Sensillae bases about midway between lines of AL and PL. Setae on palpal femur and genu long branched; on tibia, dorsal nude, lateral and ventral branched. DS to 60μ long, tapering and finely ciliated, 38–40 in number, and arranged 2.8.6.6.6.6.4.2.

AW 62·0±5·2, PW 78·3±10·5, SB 24·0, ASB 24·0, PSB 24·0, SD 48·0, A–P 38·3±6·2, AM 57·0, AL 35·0±5·2, PL 62·0± 5·2, Sens. ?

Trombicula leveri sp. n.

Scutum about as in *insolli*, with sensillae bases at about two-thirds distance from AL to PL. All setae of palpal femur, genu and tibia branched. DS 32 in number, to 36μ long and arranged ca 2.6.6.6.6.4.2.

AW 47·9±2·8, PW 61·9±8·9, SB 19·6, ASB 30·2±3·5, PSB 14·0, SD 44·2±3·5, A–P 38·1±8·1, AM 41·1±4·3, AL 42·35± 2·9, PL 47·6, Sens. 68·6.

Trombicula (*N.*) *harrisoni* sp. n.

58. Scutum as long as wide between AL, with SB in front of line of PL. AL the shortest, PL the longest. All setae on palpal femur, genu and tibia (except ? ventral) nude. DS 38 in number, to 56μ long and arranged 2.8.8.8.6.4.2.

AW 58·7, PW 81·5, SB 26·1, ASB 34·5, PSB 27·6, SD 62·1, A–P 41·4, AM 55·2, AL 34·5, PL 76·0, Sens. —.

Trombicula piercei Ewing 1931.

Scutum distinctly wider than long 59

59. Scutum pentagonal 60

Scutum not pentagonal 61

60. Scutum small; its posterior angle more acute and with short internally radiating lines. Seta on palpal femur with 2–3 short branches; on genu nude; on tibia only the ventral branched. Dorsal setae 22 in number, and arranged 2.6.6.4.2.2.

AW 47·6±3·8, PW 63·1±9·5, SB 17·4±3·8, ASB 20·1±5·1, PSB 22·4, SD 42·5±5·1, A–P 17·3±3·4, AM 31·1±5·0, AL 25·75±6·6, PL 32·3±4·4, Sens. 59·4.

Trombicula (*T.*) *frittsi* Wharton 1945.

Scutum larger, its posterior angle more obtuse, without internally radiating lines. Setae on palpal femur, genu and tibia as above. Dorsal setae 44 in number, to 47μ long, and arranged ca. 2.13.9.8.5.5.2.

AW 81·9±4·2, PW 98·7±4·2, SB 34·6±4·0, ASB 29·4±4·8, PSB 33·6, SD 63·0±4·8, A–P 30·8, AM 42·0±6·9, AL 42·7± 4·2, PL 54·6, Sens. 84·0.

Trombicula kashmirensis sp. n.

61. Scutum small, posterior margin moderately deep behind line of PL 61a
Scutum larger, posterior margin not so deep behind line of PL and more or less flattened medially 62

61a. Posterior margin deep behind PL, broadly rounded medially and lightly concave laterally. Seta on palpal femur 4–5 branched; on genu 1-branched; on tibia all three nude. Dorsal setae stiff and short, to 20μ long, 32 in number, arranged 2.6.6.4.6.4.2.2.

AW 50·4, PW 67·2, SB 19·6, ASB 25·2, PSB 19·6, SD 44·8, A–P 22·4, AM 19·6, AL 16·8, PL 25·2, Sens. 57·6.

Trombicula incurva sp. n.

Posterior margin not so deep, medially lightly concave. Seta on palpal femur strongly branched, on genu nude, only ventral seta on palpal tibia branched. Dorsal seta 30 in number to 40μ long, tapering and ciliated, and arranged 2.8.6.6.4.2.2.

AW 50·9±13·35, PW 58·95±13·5, SB 19·8±2·1, ASB 20·1, PSB 10·05, SD 30·15, A–P 20·1, AM 26·8, AL 26·8, PL 30·15, Sens. —.

Trombicula vietzi sp.n.

62. Dorsal setae 28 in number, arranged 2.8.6.6.4.2, to 50μ long. Palpal femur and genu with long curved and strongly branched setae; tibia with all 3 setae nude. Body ovate.

AW 74·8±5·9, PW 85·0±5·5, SB 25·5±5·0, ASB 29·0±4·2, PSB 17·6±2·6, SD 46·5±5·1, A–P 29·7±1·0, AM 31·9±4·3, AL 39·6±5·9, PL 53·8±9·3, Sens. 45·25±5·7.

Trombicula (*L.*) *myzantha* sp. n.

Dorsal setae 34 in number, arranged 2.12.8.6.4.2, to 50μ long. Setae on palpal femur and genu branched; on tibia all 3 nude. Body cordate, widest across shoulders.

AW 72·6±4·0, PW 78·0±6·3, SB 24·0, ASB 32·4±4·0, PSB 15·0, SD 46·8±4·9, A–P 30·6±4·0, AM 42·0, AL 47·4±4·0, PL 52·8±4·9, Sens. 50·0. *Trombicula* (*? L.*) *robusta* (Gunther 1941).

63. PL scutal and all dorsal setae broadly foliate or phyllode-like .. 73
All scutal and dorsal setae normal 64

64. Palpal claw bifurcate 65
Palpal claw trifurcate 68

65. Scutum roughly pentagonal, with the depth of posterior margin much greater than distance between SB and line of PL. AL setae set well back from the rounded antero-lateral shoulders and behind AM. All setae on palpal femur, genu and tibia nude. Coxae III bi-setose. Dorsal setae stiff and spine-like, curved, ca. 50 in number, to 40μ long and arranged 2.6.6.6.6.6.6.6.4.2.

AW 53·2, PW 56·0, SB 22·0, ASB 30·8, PSB 33·6, SD 64·4, A–P 28·0, AM 40·0, AL 25·2, PL 50·4, Sens. 56·0.

Trombicula rajoriensis sp.n.

Scutum not pentagonal 66

66. Scutum about as long as wide between AL. Dorsal setae thickened basally then tapering, finely ciliated, 26 in number to 87μ long and arranged 2.8.6.6.4. Setae on palpal femur and genu nude, on tibia only ventral branched.

AW 72·8–78·4 (aver. 74·7), PW 92·4–98·0 (94·3), SB 36·4–42·0 (38·7), ASB 44·8–47·6 (45·7), PSB 19·6–22·4 (21·5), SD 67·2, A–P 44·8–47·6 (45·7), AM 72·8–75·6 (74·2), AL 50·4–56·0 (54·1), PL 89·6, Sens. —.

Trombicula sylvestris Audy and Traub 1950.

Dorsal scutum much shorter than wide between AL, almost rectilinear, but with posterior margin shallow 67

67. Setae on palpal femur and genu branched, on tibia only dorsal ciliated. Posterior shallow and evenly curved behind PL. Dorsal setae 26 in number, to 53μ long, and arranged 2.8.6.6.4.

AW 58·8, PW 72·8, SB 32·0, ASB 28·0, PSB 12·0, SD 40·0, A–P 22·4, AM 53·2, AL 56·0, PL 64·0, Sens. 60·0.

Trombicula muridia sp. n.

Setae on palpal femur and genu nude, on tibia only dorsal ciliated. Posterior margin sinuous but almost rectilinear between PL. DS 28 in number to 66μ long, and arranged 2.8.6.6.4.2.

AW 64·5±6·7, PW 71·3±6·7, SB 30·1±3·5, ASB 25·0, PSB 11·0, SD 36·0, A–P 29·8±4·0, AM 51·5±6·9, AL 52·3±9·1, PL 58·25±11·5, Sens. 68·55±8·8.

Trombicula bodensis (Gunther 1940).

68. Dorsal setae 40 or more in number 69

Dorsal setae 28 to 34 in number 70

69. Dorsal setae 40 in number, to 45μ long and arranged 2.10.8.8.6.4.2. Setae on palpal femur and genu branched; on tibia, dorsal and lateral nude, ventral branched.

AW 70·5±5·1, PW 83·5±9·0, SB 25·5±2·5, ASB 28·3±2·5, PSB 13·6±2·7, SD 41·9±5·4, A–P 24·4±5·4, AM 33·2±9·4, AL 38·7±10·5, PL 51·2±5·4, Sens. 63·0.

Trombicula gliricolens (Hirst 1915).

Dorsal seta 54 in number, stiff and needle-like, arranged 2.10.8.10.12.6.4.2. Seta on palpal femur 2–3 long branches; on genu 1–2 long branches; on tibia, dorsal and lateral nude, ventral branched.

AW 64·5±6·3, PW 79·5±10·9, SB 22·6±4·3, ASB 24·9±5·9, PSB 15·3±2·2, SD 40·2±6·2, A–P 23·6±4·1, AM 35·75±5·6, AL 27·8±6·0, PL 32·0±4·9, Sens. 55·3±11·6.

Trombicula philipi sp. n.

70. Dorsal setae of palpal tibia ciliated or branched, lateral and ventral nude; setae on femur and genu ciliated or branched. Sensillae slightly behind line of PL, with short ciliations or barbs basally, longer distally. DS 28 in number, to 64μ, arranged 2.8.6.6.4.2.

AW 70·4, PW 78·9±9·5, SB 33·5±4·1, ASB 31·4±4·3, PSB 14·7±2·1, SD 46·1±5·2, A–P 27·2±4·8, AM 59·5±8·5, AL 46·7 ±5·2, PL 71·0±4·3, Sens. 70·4.

Trombicula (*L.*) *burmensis* (Ewing 1945).

All 3 setae of palpal tibia, as well as the setae on femur and genu ciliated or branched. Scutum rugose, with SB in front of line of PL and posterior margin as even shallow curve. DS 28 in number, to 30μ long, thick with short setulations and arranged 2.8.6.6.4.2.

AW 56·7±6·9, PW 78·0, SB 18·0, ASB 21·0, PSB 18·0, SD 39·0, A–P 30·0, AM 30·0, AL 25·0±5·2, PL 36·0, Sens. 50·0.

Trombicula southcotti sp. n.

Only the ventral of the palpal tibial setae branched 71

71. Scutum short, with PW much greater than AW, so that the angle at AL is very obtuse; posterior margin evenly crescentic; sensillae bases in line with PL; surface strongly rugose. Setae on palpal femur and genu ciliated. DS 28 in number, to 40μ long, and arranged 2.8.6.6.4.2.

AW 58·8±5·3, PW 83·8±4·9, SB 20·2±6·1, ASB 21·0, PSB 16·75±8·7, SD 38·25±8·6, A–P, 23·5±6·2, AM 30·75±4·5, AL 27·0, PL 44·0±6·7, Sens. 50·0.

Trombicula quadriense Wom. and Heasp. 1943.
= *chiroptera* Wom. and Heasp. 1943.

Scutum more rectangular with posterior margin sinuous 72

72. Scutum smaller, with strong sparse punctations, and sensillae behind line of PL. Seta of palpal genu nude. DS 34 in number, short to 28μ, arranged 2.8.6.6.6.4.2.

AW 43·2, PW 53·2, SB 16·0, ASB 21·8, PSB 7·0, SD 28·8, A–P 16·0, AM 30·0, AL 28·8, PL 35·6, Sens. —.

Trombicula pelta sp. n.

Scutum larger, surface only lightly punctate. Sensillae bases in line with PL. Seta of palpal genu ciliated or branched. Dorsal setae 30 in number, to 50μ long and arranged 2.8.6.6.4.2.2.

AW 67·2, PW 81·2, SB 28·0, ASB 25·2, PSB 11·2, SD 36·4, A–P 25·2, AM 50·4, AL 44·8, PL 50·4, Sens. 56·0.

Trombicula (*N.*) *jayewickremei* sp. n.

73. PL and dorsal setae aciculate-foliate with longitudinal rows of setules 74

PL and dorsal setae broadly phyllode-like with fine punctations or with large-reticulations 75

74. Dorsal setae 32 in number, to 84·0μ × 28·0μ, arranged 2.8.6.6.4.4.2, the posterior rows shorter. Ventrally without any foliate setae; the setae behind coxae III short, to 30μ and arranged 6.6.4.2.2.2.

AW 84·0, PW 106·4–112·0, SB 50·4, ASB 33·6, PSB 22·4, SD 56·0, A–P 16·8, AM 75·0, AL 36·4, PL 84·0 × 28·0, Sens. —.

Trombicula cuneata (Traub and Evans, 1951).
Trombiculindus cuneatus Traub and Evans, 1951.

Dorsal setae 40 in number, arranged 2.6.6.8.8.6.4, not much shorter posteriorly, and the first 6 between the humerals much more slender than the rest. Ventrally behind coxae III with ca. 32 long, slender, and fine aciculate-foliate setae as on the dorsum.

AW 95·2, 98·0, PW 117·6, SB 47·6, ASB 39·2, PSB 28·0, SD 67·2, A–P 28·0, AM 75·6, 72·8, AL 47·6, 53·2, PL 112·0 × 42·0, 106·8 × 42·0, Sens. —. *Trombicula squamifera* sp. n.

75. PL and dorsal setae very broad and overlapping and entirely covering dorsum, finely punctate, 28 in number, arranged 2.8.6.6.4.2. Ventrally behind coxae III with ca. 20 long, ciliated setae followed by ca. 16 setae similar to those on the dorsum.

AW 88·0, PW 100·0, SB 40·0, ASB 36·0, PSB 11·0, SD 47·0, A–P 31·0, AM 73·0, AL 67·0, PL 75·0, Sens. 80·0 × 54·0.
Trombicula squamosa (Radford 1947).
(= *Trombiculindus squamosus* Radford 1947).

PL and dorsal setae smaller, not overlapping, with large reticulations, 30 in number, arranged 2.8.6.6.4.2.2. Ventrally behind coxae III with 8.4.2.2. short fine ciliated setae only.

AW 70·0, PW 86·8, SB 44·8, ASB 30·8, PSB 16·8, SD 47·6, A–P 14·0, AM 39·2, AL 36·4, PL 78·4 × 39·2, Sens. —.
Trombicula foliacea (Traub and Evans, 1951).
(=*Trombiculindus foliaceus* Traub and Evans 1951).

Subgenus LEPTOTROMBIDIUM Nagayo et al. 1917.

Leptotrombidium Nagayo *et al.*, 1917, J. Exper. Med., 25, (2), 2–3. Type *Trombicula akamushi* Brumpt.

The above name was used generically by Nagayo and his co-authors for *Trombicula akamushi* when, on rearing the nymphs and adults they found that these differed from the adults of other species of Trombidiids then known to them. In a later paper, and subsequently, they dropped the name *Leptotrombidium* on realizing that the adults and nymphs conformed to Berlese's genus *Trombicula* Berl. 1904. They did not however, point out that the Japanese species differed from the type of *Trombicula* (*minor* Berl. 1904) in lacking eyes.

In the adult section of the present work, however, it is shown that *akamushi, deliensis* and other allied species do not only differ from the genotype of *Trombicula* s. str. in lacking eyes, but that they are also characterized by possessing distinct precoxal plates on leg I which meet in the median line to form a longitudinally divided sternum (as was well figured originally by Walch for *deliensis*).

In 1946, Wharton stressed the fact that the two species, proven to be vectors

of tsutsugamushi disease, *akamushi* and *deliensis*, together with other closely allied species, form a small group which he termed the "*akamushi*" group. On the basis of the larvae, he further showed that this group might not be confined to the Asiatic-Pacific Region as he was unable to distinguish an American species *T. myotis* Ewing, except on the ornamentation of the surface of the dorsal scutum.

Of the species here placed in *Leptotrombidium* on larval characters only, *akamushi* Brumpt, *pallida* Nagayo *et al.*, *deliensis* Walch, *burmensis* Ewing and *myzantha* sp. n. are also known from the adult or nymphal stages. In 1921, Nagayo and colleagues claimed to have reared nymphs of three other Japanese species, *palpalis*, *intermedia* and *scutellaris*, but were unable to separate them from *pallida* or *akamushi*. No further studies of these species, however, appear to have been made.

On larval characters the sub-genus may be diagnosed as follows: Palpal claw bi- or trifurcate. Setae on palpal femur and genu nude; on tibia the dorsal ciliated, the lateral and ventral (except in *palpalis*, etc.) nude. Galeal setae strongly ciliated (nude in *myzantha*). No long nude, outstanding setae on tarsi or metatarsi of leg III. Dorsal scutum trapezoidal. Scutal and dorsal setae long, tapering, ciliated or with fairly strong denticles.

TROMBICULA (? LEPTOTROMBIDIUM) PALPALIS (Nagayo *et al.* 1919).

Trombicula palpalis Nagayo *et al.* 1919, Verhd. d. jap. pathol. Gesellscht., Tokyo. 10, 107; *idem* 1920, 10, 471; *idem* Amer. J. Hyg., 1, (5–6), 1921; Womersley and Heaslip, 1943, Trans. Roy. Soc. S. Aust., 67, (1), 90.

Plate 3, fig. A–F.

A considerable number of specimens, remounted separately, from mixed original preparations kindly given to Lt.-Col. C. B. Philip by Dr. T. Tamiya, from Yamagata Prefecture, Japan, have been studied.

This species, which is as yet unknown outside of Japan, agrees with the following four species in not having the PL setae placed distinctly at the postero-lateral corners of the scutum. It differs from these, and the preceding three species also, in that the ventral seta on the palpal tibia is branched and in having the seta of coxae III placed on the anterior coxal margin. Other specific differences lie in the number and arrangement of the dorsal setae.

Over thirty remounted specimens, from Okiage and Orato in Yamagata Prefecture, Sept. to Dec. 1920, have been studied. On the original slides this species was indicated by the sign (小) or *sho*, translated by Mr. N. B. Tindale as meaning "small" and presumably referring to the more slender dorsal seta than in *pallida*. No recent material has been seen.

Re-description of Larvae (mainly after Nagayo). Colour in life orange red. Shape oval. Length (unengorged) to 264μ, width to 172μ. Scutum rectangular with PL at the posterior corners; the posterior margin deep behind SB, straight medially and strongly curved laterally; the anterior margin sinuous; sensillae filamentous, nude on proximal fourth, strongly ciliated on distal three-fourths, bases slightly behind line of PL; PL setae the longest. Eyes 2 + 2, close to lateral borders of scutum. Chelicerae with only the apical tricuspid cap. Galeal setae strongly ciliated. Palpi stout, with trifurcate tibial claw; all setae on femur, genu and tibia, except the dorsal and ventral on tibia, nude. Dorsal setae, more slender and tapering than in *pallida* or *intermedia* but still with rather strong setules, to 51μ long, ca. 44 in number, and arranged 2.10.10.10.6.4.2. Ventral setae similar to dorsal, one on each coxa with that of coxae III placed on anterior margin, a pair of setae between coxae I and between coxae III and thereafter ca. 45 setae. Legs as long as and similar to *pallida*.

The Standard Data derived from 28 specimens are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	65·5±0·44	2·34±0·31	58·5–72·5	63·0–70·0	3·6
PW	70·3±0·41	2·45±0·30	63·6–77·0	66·0–75·0	3·2
SB	29·8±0·26	1·37±0·18	25·7–33·9	27·0–33·0	4·6
ASB	24·0	No variation recorded			
PSB	15·0	No variation recorded			
SD	39·0	No variation recorded			
A–P	18·5±0·24	1·27±0·17	14·7–22·3	15·0–21·0	7·0
AM	46·4±0·44	2·24±0·31	39·7–53·1	42·0–51·0	4·8
AL	36·5±0·32	1·70±0·23	31·4–41·6	33·0–42·0	4·6
PL	58·1±0·46	2·42±0·32	50·8–65·4	54·0–63·0	4·2
Sens.	67·0±1·22	2·74±0·87	58·8–75·2	65·0–70·0	4·1

TROMBICULA (? LEPTOTROMBIDIUM) KEUKENSCHRIJVERI Walch 1923.

Trombicula keukenschrijveri Walch 1923, Tr. Vth. Bien. Cong. Far East. Assoc. Trop. Med., 583, Singapore (1924); Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 1943.

Trombicula (*Trombicula*) *keukenschrijveri*, Sig Thor and Willmann 1947, Das Tierreich, Lfg., 71b, 268.

Plate 3, fig. G–J.

This species was originally described from a single specimen on man at Deli in Sumatra. Until now, no further specimens appear to have been recorded.

Recently, however, Dr. J. R. Audy has forwarded me a slide from amongst the Gater material left at the I.M.R., Kuala Lumpur, and labelled by Gater as

keukenschrijveri, and also a number of freshly collected specimens from Kuala Lumpur, which agree with this species.

A fresh description based on this material is as follows:

Larvae. Shape oval. Length (engorged) to 495μ, width to 420μ. Scutum as figured, with the posterior corners well rounded, and PL about midway between the anterior and posterior scutal margins; scutal setae relatively thin and shortly ciliated, AL the shortest, PL the longest; sensillae filamentous and ciliated on distal half, the bases behind line of PL. Eyes 2 + 2, posterior the smaller. Chelicerae simple, with only the apical tricuspid cap. Palpi stout, tibial claw trifurcate; setae on femur and genu nude; on tibia, dorsal ciliated or branched; lateral and ventral nude. Dorsal setae 2.12.10.4.10.8.4 = 50, to 45μ. (Walch gives 13.4.6.8.11.8.4, but figures them as 2.12.4.10.4.10.8.4.) Ventrally with a pair of branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 46 setae to 40μ long. Legs 7-segmented, I 234μ long, II 208μ, III 260μ; tarsi I and II with usual dorsal sensory rod; no long nude seta on tarsi III.

The Standard Data derived from 6 of the above specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	58·8	No variation recorded			
PW	68·6±0·63	1·53±0·44	64·0–73·2	67·2–70·0	2·2
SB	28·9±0·47	1·14±0·33	25·5–32·3	28·0–30·8	4·0
ASB	27·1±0·59	1·44±0·42	22·8–31·4	25·2–28·0	5·3
PSB	11·2	No variation recorded			
SD	38·3±0·59	1·44±0·42	34·0–42·6	36·4–39·2	3·8
A–P	23·3±0·59	1·44±0·42	19·0–27·6	22·4–25·2	6·2
AM	51·5±1·43	3·19±1·01	41·9–61·1	47·6–56·0	6·2
AL	44·8±0·88	1·98±0·63	38·9–50·7	42·0–47·6	4·4
PL	54·9±0·69	1·53±0·48	50·3–59·5	53·2–56·0	2·8
Sens.	61·6±1·14	2·29±0·81	54·8–68·4	58·8–64·4	3·7

Remarks. This species in the trifurcate palpal claw, the setation of the palpi, and the ciliated galeal setae belongs to the "*akamushi*" group of Wharton, referred here to the subgenus or genus *Leptotrombidium* Nagayo. In the broadly rounded postero-lateral corners of the scutum it is closely related to *pallida* Nagayo from Japan, but distinctly differs in the structure of the scutal and dorsal setae.

TROMBICULA (LEPTOTROMBIDIUM) PALLIDA (Nagayo *et al.* 1919).

Trombicula pallida Nagayo *et al.* 1919, Verhdl. d. jap. pathol. Gesellsch., Tokyo, 9, 107; *idem,* 1921, Amer. J. Hyg., 1, (5–6), 569; Womersley and Heaslip 1943, Trans. Roy. Soc. S. Aust., 67, (1), 75.

Plate 3, fig. K–P.

In addition to the material reported upon in 1943 (Womersley and Heaslip) over 60 specimens remounted singly from slides of mixed species given to Lt.-Col. C. B. Philip by Dr. T. Tamiya have now been studied. The material was collected by Nagayo and his colleagues in 1919 and 1920 from Yamagata Prefecture, Japan, the localities, as translated for me by Mr. N. B. Tindale being Arato, Okiage, and Nukanome.

On these slides which contained specimens of *pallida,* this species was indicated by the character for "dai" (大), meaning "big" or "great," and presumably referring to the big (or thick) dorsal setae.

In addition to the above material, 13 other specimens, 5 from a vole *Microtus montebelli* from Agamo River, Niigata Prefecture, and 8 from *Apodemus speciosus* from Yacki, Yamagata Pref., all collected by Lt.-Col. C. B. Philip in 1945, have been examined. No material referable to this species has so far been seen from anywhere outside of Japan.

Trombicula pallida is here placed in the subgenus *Leptotrombidium* on the characters of the adult. In the larval stage it differs from its nearest allies, *keukenschrijveri, intermedia,* etc., as given in the key, and particularly in the number and character of the dorsal setae.

A re-description of the larvae (mainly after Nagayo), together with the Standard Data, derived from 31 specimens, is as follows:

Larvae. Shape oval. Colour in life orange red. Length (unengorged) to 264μ, width to 172μ. Scutum rectangular with anterior margin sinuous and slightly convex medially; posterior margin slightly concave medially; PL situated about midway between AL and extreme posterior margin and not at the postero-lateral corners, which are well rounded; sensillae filamentous, with minute barbs on proximal third, and strong numerous ciliations on distal two-thirds; sensillae bases slightly behind line of PL. Scutal setae stout, blunt, with strong denticulations. Eyes 2 + 2, close to lateral margins of scutum, posterior the smaller. Chelicerae with only the apical tricuspid cap. Galeal setae strongly ciliated. Palpi stout, somewhat angular basally; tibial claw trifurcate; all setae on femur, genu and tibia nude, except the dorsal tibial. Dorsal setae stout, strongly denticulate, blunt and shorter than in *palpalis, keukenschrijveri,* etc., to 43μ long, ca. 70 in number, and arranged ca. 2.14(12).12(14).12.10.8.6.4.2. Ventrally the setae are similar to the dorsal, a pair (of longer branched ones) on maxillae, one on each coxa, a pair between coxae I and between coxae III, and thereafter approx. 50 in number. Legs: I 190μ long, II 160μ, III 200μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for 31 specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	70·5±0·30	1·70±0·21	65·4–75·6	66·0–75·0	2·4
PW	76·75±0·57	3·20±0·41	67·15–86·35	72·0–85·0	4·2
SB	35·6±0·33	1·83±0·23	30·1–44·1	33·0–39·0	5·1
ASB	26·7±0·16	0·89±0·11	24·0–29·4	24·0–27·0	3·3
PSB	14·8±0·10	0·59±0·07	13·0–16·6	13·0–15·0	4·0
SD	41·5±0·18	1·01±0·13	38·5–44·5	39·0–42·0	2·4
A–P	19·0±0·22	1·26±0·16	15·0–23·0	18·0–21·0	6·6
AM	49·8±0·36	1·86±0·26	44·2–55·4	48·0–54·0	3·8
AL	42·15±0·31	1·74±0·22	36·9–47·4	40·0–45·0	4·1
PL	53·3±0·42	2·32±0·30	46·3–60·3	50·0–57·0	4·4
Sens.	71·5±0·76	2·41±0·54	64·3–78·7	70·0–75·0	3·4

TROMBICULA (LEPTOTROMBIDIUM) INTERMEDIA (Nagayo *et al.* 1920).

Trombicula intermedia Nagayo *et al.* 1920. Verhdl. d. jap. pathol. Gesellscht., Tokyo, 10, 471; *idem* Amer. J. Hyg., 1, (5–6), 569, 1921; Womersley and Heaslip, Trans. Roy. Soc. S. Aust., 67, (1), 90 1943.

Plate 3, fig. Q.

Re-description of Larvae (after Nagayo *et al.* 1920). Shape oval. Colour in life orange red. Length to 264μ, width to 172μ. Scutum rectangular, with posterior corners well rounded, and PL about midway between anterior and posterior borders. Sensillae about in line or slightly behind line of PL, proximal third with minute barbs, distal two-thirds strongly ciliated. Normal scutal setae stout, with strong denticles, but not so heavy as in *pallida*. Eyes 2 + 2, the posterior the smaller. Chelicerae with only the apical tricuspid cap. Galeal setae ciliated. Palpi stout, tibial claw trifurcate; setae on palpal femur, genu and tibia all nude, except dorsal on tibia. Dorsal setae very thick, blunt, and strongly denticulate, 38–40 in number, arranged 2.10.8.8.6.4.2(0), to 57μ long. Ventral setae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 34 similar to dorsal. Legs as in *pallida;* tarsi I and II probably with the usual dorsal rod or spur, III without any long nude seta.

The Standard Data (after Nagayo *et al.* 1920, and Womersley and Heaslip 1939)are: AW 53·0, PW 60·0, SB 22·5, ASB 23·5, PSB 23·0, SD 46·5, A–P 18·0, AM 53·0, AL 41·0, PL 57·0, Sens. 65·0.

Remarks. Amongst the Japanese material which I have been able to study, it has not been possible to identify any specimens with certainty, as *intermedia* Nagayo *et al.*

Kuwato, Berge and Philip 1950, however, record specimens from "indigenous small animal hosts" from North slopes of Mount Fuji, Fujino Susono

(Gatemba), Oct. 1948 (Major T. L. Berge), along with *T. akamushi, palpalis, pallida, scutellaris,* and a new species *T. fuji,* as well as a *Gahrliepia* sp.

These authors give the following Standard Data for two specimens of *intermedia,* the values of which are higher than those quoted above, as interpolated by Womersley and Heaslip 1943, from the published figures of Nagayo *et al.*

AW	PW	SB	ASB	PSB	SD	A–P	AM	AL	PL	Sens.
71·5	78·5	34·0	—	12·5	—	24·5	50·5	41·5	55·0	62·0
69·0	79·0	33·5	—	12·5	—	23·5	49·?	38·?	54·5	59·?

These higher values are probably more indicative of the measurements to be expected.

TROMBICULA (? LEPTOTROMBIDIUM) FUJI Kuwato Berge and Philip 1950.

Trombicula (*Leptotrombidium*) *fuji* Kuwato, Berge and Philip 1950, J. Parasitology, 36, (1), 80).

Plate 4, fig. A–C.

This interesting species, which on larval characters was placed by the authors in the subgenus *Leptotrombidium,* was described from larvae from *Apodemus speciosus speciosus* Temminck and Schlegel, *Microtus montebelli montebelli* Milne-Edwards, and *Urotrichus talpoides hondonis* Thomas, from the Fujino Maneuver Area near the base of Mt. Fuji, south-west of Tokyo, Japan, in Oct. 1948.

In June, 1949, further specimens were obtained from *Apodemus speciosus* and *A. geisha* Thomas, in the same area.

Larvae. Size (fully engorged) 515μ wide by 670μ long. Colour in life pale reddish yellow. Scutum small, roughly rectangular, sparsely punctate, with SB well behind line of PL, and the posterior corners well rounded with PL not at the corners but much nearer to AL. Sensillae filamentous, strongly ciliated on distal two-thirds and minutely barbed basally. PL more than twice as long as AL and strongly ciliated. Eyes 2 + 2, posterior the smaller. Palpal tibial claw trifurcate; setae on femur and genu nude, dorsal ciliated. Dorsal setae 30–32 in number, from 50μ long anteriorly to 30μ posteriorly, barbed, and arranged ca. 2.8.6.6.2.6.2. with slight variation. Ventrally, all coxae 1-setose, a pair of branched setae on maxillae, a pair between coxae I and between coxae III, and thereafter ca. 24 small preanal and 18 longer postanal setae. Legs all 7-segmented; no long nude seta on tarsi III.

The Standard Data for the type and 9 paratypes as given by the authors are:

	AW	PW	SB	A–P	SD	PSB	PL–SB	AM	AL	PL	Sens.
Type	50·5	52	24	14	30·5	11	10·5	29·5	28·5	51	40·5
Extremes	44–50	48–55	21–24	13–14	30–37	10·15	10·11	26–30	23–27	45–48	33–40
Mean	49	51·38	23	13·4	33·98	12·2	10·2	27·5	25·5	46·8	35·9

Remarks. When the adults and/or nymphs of this species become known the assignment of the larvae to *Leptotrombidium* will probably be confirmed.

The figures given in this paper are re-drawn from the author's published figures, that of the scutum being at a magnification of 500 times for comparison with other species.

TROMBICULA (? LEPTOTROMBIDIUM) LANCEOLATA sp. n. Lawrence in MS.

Plate 4, fig. D–I.

Description of Larvae. Shape oval. Length (engorged) to 425μ, width to 357μ. Scutum trapezoidal, with posterior lateral corners well rounded, and PL about midway between AL and posterior margin; surface finely punctate; sensillae filamentous, finely barbed on basal half and ciliated on distal half, bases fairly wide apart and well behind line of PL. Eyes 2 + 2, closely adjacent to scutum and posterior the smaller. Chelicerae not serrate, with only the apical tricuspid cap. Galeal setae strongly branched. Palpi stout, tibial claw trifurcate; setae on palpal femur and genu, and ventrally and laterally on tibia nude, dorsally on tibia branched. Dorsal setae thick, with strong denticles, 28 in number, arranged 2.8.6.6.4.2, to 58μ long. Ventrally, with a pair of ciliated or branched setae on maxillae, a slender ciliated seta on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 13–14 fine ciliated setae, followed by 6.4.2. setae similar to but smaller than the dorsal setae. Legs all 7-segmented, I 260μ long, II 227μ, III 273μ; tarsi I and II with the usual dorsal sensory rod, III without any long nude seta.

The Standard Data derived from nine specimens are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	58·5±0·98	2·95±0·69	49·7–57·3	53·2–61·6	5·0
PW	69·4±0·78	2·33±0·55	62·4–76·4	67·2–72·8	3·4
SB	31·1±0·53	1·61±0·38	26·3–35·8	28·0–33·6	5·1
ASB	28·0	No variation recorded			
PSB	11·2	No variation recorded			
SD	39·2	No variation recorded			
A–P	20·85±0·49	1·47±0·35	16·4–25·3	19·6–22·4	7·0
AM	40·8±0·83	2·20±0·59	34·2–47·4	39·2–44·8	5·4
AL	50·4±0·93	2·80±0·66	42·0–58·8	47·6–56·0	5·6
PL	56·0±0·47	1·40±0·47	51·8–60·2	53·2–58·8	2·5
Sens.	68·3±1·12	2·50±0·79	60·8–75·8	64·4–70·0	3·7

Loc. and Hosts. The above description is drawn up from nine specimens from *Nesokia bengalensis* and *Rattus norvegicus* from Insein, Paungde and Prome in Southern Burma, collected by T. H. Lawrence 1945.

These specimens were amongst the material deposited in the British Museum (N.H.) by Lawrence and marked in his list as "lanceo" but no description appears to have been made by him.

Remarks. In the setation of the palpi, galeal setae, the shape of the scutum and the structure of the dorsal setae, this species is very close to *intermedia* Nagayo *et al.* from Japan. It also agrees with that species in the Standard Data, but differs in the number of dorsal and ventral setae, and from Nagayo's figures,in that the ventral setae are not all alike and similar to dorsal. In *lanceolata* only the 3 posterior rows of setae conform to the dorsal structure.

TROMBICULA (LEPTOTROMBIDIUM) PARAPALPALIS sp. n.

Plate 10, fig. A–E.

Description of Larvae. Shape oval. Length (unengorged) 286μ, width 182μ. Scutum wider than long, finely punctate; anterior margin lightly concave; posterior margin fairly deep behind line of PL, laterally and medially slightly concave; sensillae bases fairly wide apart and behind line of PL. Eyes 2 + 2, posterior the smaller, on ocular shields. Chelicerae with only the apical tricuspid cap. Galeal setae branched or ciliated. Palpi stout, tibial claw trifurcate; seta on palpal femur and genu nude, on tibia both dorsal and ventral branched or ciliated. Dorsal setae 52 in number, arranged ca 2.13.12.12.8.4.2, to 56μ long, and tapering with fairly long ciliations. Ventrally with a pair of branched setae on maxillae, one on each coxae, a pair between coxae I and between coxae III and thereafter ca. 40 setae to 36μ. Legs: I 285μ, II 260μ, III 312μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for the type and 5 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	76·1±0·86	2·11±0·61	69·8–82·4	73·8–78·4	2·7
PW	86·8±1·25	3·07±0·88	77·6–96·0	84·0–92·4	3·5
SB	35·5±0·59	1·45±0·42	31·2–39·8	33·6–36·4	4·0
ASB	30·8	No variation recorded			
PSB	14·0	No variation recorded			
SD	44·8	No variation recorded			
A–P	25·2	No variation recorded			
AM	63·8±0·56	1·25±0·40	60·0–67·6	61·6–64·4	2·0
AL	48·5±0·51	1·44±0·42	44·2–52·8	47·6–50·4	3·0
PL	63·8±0·56	1·25±0·40	60·0–67·6	61·6–64·4	2·0
Sens.	85·4 (Mean of 84·0 and 86·8). Only two determinations.				

Loc. and Hosts. The type and 5 paratypes from a rat, from Kanzalwan, Kashmir, India, 1949 (S. L. Kalra), and 3 other specimens from rat from Gurais, Kashmir, 1949 (S.L.K.).

Remarks. Somewhat closely related to *palpalis*, but much more so to *macacus* sp. n. Lawrence, in the palpal setation, the shape of the scutum and the number and arrangement of the dorsal setae. From *macacus*, however, it can be separated as in the key on the larger scute, and more particularly on the different structure of the dorsal setae. These are tapering with long ciliations, whereas in *macacus* they are almost uniformly thick to the apex with strong setules rather than ciliations.

TROMBICULA (? LEPTOTROMBIDIUM) MACACUS sp. n.

Trombicula n. sp. "F." Lawrence in MS. In Audy 1947, "Scrub Typhus Investigations in S.E. Asia, Pt. III. Appendix 7." AMD. 7. War Office, London.

Plate 5, fig. A–F.

Description of Larvae. Shape oval. Colour in life unknown. Length 260μ, width 182μ. Scutum trapezoidal with the anterior margin lightly sinuous, PL at the postero-lateral angles, posterior margin not very deep behind line of PL and straight medially, sensillae in line with or slightly anterior of line of PL, sensillae filamentous and ciliated distally. Chelicerae with only the apical tricuspid cap. Galeal setae feathered or ciliated. Palpi stout, tibial claw trifurcate; setae on palpal femur and genu nude, on tibia both dorsal and ventral branched, lateral nude. Eyes 2 + 2, posterior the smaller. Dorsal setae moderately stout and blunt with strong denticles, to 40μ long, and arranged 2.10.8.10.8.6.4.2. Ventrally all coxae unisetose, a pair between coxae I and between coxae III, and thereafter ca. 50, which, except for the 2 or 3 posterior rows, are much more slender and tapering than the dorsal setae. Legs: I 227μ long, II 200μ, III 247μ; tarsi I and II with the usual dorsal sensory rod ("spur" of Brennan and Wharton); III without any long nude seta on tarsi or metatarsi.

Standard Data are: AW 64·4, PW 75·6, SB 30·8, ASB 28·0, PSB 11·2, SD 39·2, A–P 26·2, AM 47·6, AL 40·0, PL 50·4, Sens. 61·6.

Loc. and Hosts. A single specimen from *Macacus assamensis*, Imphal, 8 December, 1945 (T. J. Lawrence).

Remarks. In having the ventral as well as the dorsal seta of the palpal tibia branched, this species is closely related to *palpalis* Nagayo. It differs in the structure of the dorsal setae as well as in their number and arrangement,

and also in that, except for the two or three posterior rows, the ventral setae are very much more slender and finer than the dorsal setae, which is not the case in *palpalis*.

TROMBICULA (? LEPTOTROMBIDIUM) PUTA sp. n.

Plate 10, fig. F–J.

Description of Larva. Length (unengorged) 260μ, width 195μ. Shape broadly oval. Scutum more or less rectangular, wider than long, with posterior margin fairly deep behind line of PL; SB in line with or very slightly behind line of PL; AM well back from anterior margin; AM and AL tapering and normally ciliated, PL stout with strong denticles. Eyes 2 + 2, posterior the smaller. Chelicerae with only the apical tricuspid cap. Galeal setae branched or ciliated. Palpi stout, tibial claw trifurcate; seta on palpal femur and genu nude, on tibia only the ventral branched. Dorsal setae stout, blunt, with strong edges furnished with strong denticles, 50 in number to 36–40μ long, and arranged 4.10.8.2.8.8.6.2.2. i.e., two humeral setae on each side. Ventrally with a pair of branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, and thereafter 6.6.4.6.4.2; all ventral setae fine and tapering with ciliations, except the posterior 3 rows which are similar to the dorsal setae, to 36μ long. Legs: I 227μ long, II 208μ, III 240μ; tarsi I and II with usual dorsal sensory rod, III without any long nude seta.

Standard Data for the unique type are: AW 75·6, PW 81·2, SB 36·4, ASB 28·0, PSB 15·4, SD 43·4, A–P 25·2, AM 42·0, AL 36·4, PL 42·0, Sens. —.

Loc. and Host. A single specimen from a rat from Kanzalwan, Kashmir, India, 12 Oct., 1948 (S. L. Kalra).

Remarks. This species probably falls into the subgenus *Leptotrombidium* and comes near to *macacus* sp. n. from which it differs in the two humeral setae on each side, in the form of the dorsal setae, and other details as in the key. The dorsal setae are also very similar to those found in *T. fordi* sp. n. Lawrence, and *T. traubi* sp. n.

TROMBICULA (? LEPTOTROMBIDIUM) DUX, sp. n.

Plate 5, fig. G–L.

Description of Larvae. Size large; length (engorged) 890μ, width 780μ. Shape almost round. Scutum large, rectangular, with surface irregularly shagreened; anterior margin concave, posterior margin convex but lightly concave medially; AM missing but its base well behind AL; PL at the postero-

lateral corners; sensillae filamentous, ciliated on distal two-thirds, bases only very slightly behind line of PL. Eyes 2 + 2, indistinct and away from scutal margins. Chelicerae non-serrate, with only the apical tricuspid cap. Galeal setae strongly ciliated or branched. Palpi stout, femur angulate, tibial claw trifurcate; all setae on palpal femur, genu and tibia, except dorsal tibial, nude. Dorsal setae numerous, relatively short, from 40μ anteriorly to 50μ posteriorly, approximately 86 in number, and arranged in rows of 2.14.14. plus. Ventrally with a pair of ciliated maxillary setae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 56; from 30μ long anteriorly to 58μ posteriorly, and more slender and tapering than the dorsal setae. Anal orifice not visible. Legs all 7-segmented, 1 broken short in type, II 325μ long, III 385μ; tarsi II with usual dorsal sensory rod; III without any long nude seta on tarsi.

The Standard Data of the unique type are: AW 99·2, PW 121·6, SB 51·2, ASB 41·6, PSB 16·0, SD 57·6, A–P 35·2, AM —, AL 56·0, PL 70·4, Sens. 96·0.

Loc. and Host. A single specimen from a brown rat at Ranikhet, Kumaon Hills, India, 20 Oct., 1946 (S. L. Kalra), 11 other specimens from a "mouse" from Baltal, Kashmir, N. India, along with *T. squamifera* sp. n. These specimens have the following Standard Data:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	95·7±1·01	3·34±0·71	85·7–105·7	92·4–100·8	3·5
PW	107·4±1·41	4·67±0·99	93·4–121·4	100·8–112·0	4·3
SB	44·0±0·38	1·25±0·27	40·3–47·7	42·0–44·8	2·8
ASB	34·1±3·2	1·08±0·23	30·9–37·3	33·6–36·4	3·2
PSB	19·1±0·32	1·08±0·23	15·9–22·3	16·8–19·6	5·6
SD	53·2	No variation recorded			
A–P	30·8	No variation recorded			
AM	62·4±0·57	1·79±0·40	57·0–67·8	58·8–64·4	2·9
AL	48·2±0·52	3·01±1·73	43·0–53·4	47·6–53·2	3·6
PL	67·5±0·82	2·45±0·58	60·2–74·8	64·4–70·0	3·6
Sens.	81·2±1·61	10·41±3·23	71·5–90·9	78·4–84·0	4·0

Remarks. In the palpal claw and setae, and the galeal setae this species comes into the genus *Leptotrombidium* (*akamushi-deliensis* group of *Trombicula* s.l.), but differs in size, dorsal setae etc., as in the key.

TROMBICULA (? LEPTOTROMBIDIUM) SCUTELLARIS (Nagayo *et al.* 1920).

Trombicula scutellaris Nagayo *et al.* 1920. Verhdl. d. jap. pathol. Gesellsch., Tokyo, 10, 471; *idem* Amer. J. Hyg., 1, (5–6), 569, 1921; Womersley and Heaslip, Trans. Roy. Soc. S. Aust., 67, (1), 88, 1943, Kuwato, Berge and Philip 1950, J. Parasitol., 36, (1), 82.

Plate 6, fig. A–E.

Again no fresh material of this species has been reported until recently, when Kuwato, Berge and Philip 1950, recorded it from near the base of Mt. Fuji, near Tokyo, Japan. Amongst the slides of the original Nagayo material brought back by Lt.-Col. C. B. Philip, however, were a number of specimens from Okiage, Arato and Nukanome, all in Yamagata Prefecture, and dated Sept. 1919 and Sept. 1920.

The above specimens are in full agreement with Nagayo's description and were indicated on the slides by the ideograph (新), or *"shin,"* translated by Mr. N. B. Tindale as meaning "new" or "fresh," thus indicating a new species.

Re-description of Larvae (mainly after Nagayo). Shape oval. Colour in life orange red. Length (unengorged) 264μ, width to 172μ. Scutum roughly rectangular, with PL at the postero-lateral corners; sensillae filamentous, basal third with sparse minute barbs, distal two-thirds strongly ciliated, bases in line with PL. Scutal setae slender, tapering, with ciliations. Eyes 2+ 2, close to the postero-lateral corners of scute. Chelicerae with only the apical tricuspid cap. Galeal setae strongly feathered. Palpi stout, tibial claw trifurcate; all setae on palpal femur, genu and tibia (except dorsal) nude. Dorsal setae slender, to 51–69μ long, with stout setules, to 50 in number and arranged 2.10.10(12).10(8).8.6.4. Ventral setae behind coxae III, ca. 24 in number, shorter than but similar to dorsal setae. Tarsi of leg III without any long nude seta.

The Standard Data derived from 23 specimens from Arato, Okiage and Nakanome, Yamagata Prefecture, Japan, Sept. 1919 and Sept. 1920, are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	72·4±0·42	2·04±0·30	66·3–78·5	70·0–75·0	2·8
PW	82·2±0·72	3·46±0·51	71·8–92·6	75·0–88·0	4·2
SB	32·2±0·41	1·96±0·29	26·3–38·1	30·0–36·0	6·1
ASB	29·1±0·38	1·82±0·27	23·6–34·6	24·0–32·0	6·2
PSB	15·1±0·08	0·41±0·06	13·9–16·2	15·0–17·0	2·7
SD	44·0±0·40	1·94±0·28	38·3–49·7	39·0–47·0	4·5
A–P	28·3±0·40	1·94±0·29	22·5–34·1	24·0–30·0	6·8
AM	59·8±0·36	1·55±0·26	55·2–64·4	57·0–63·0	2·6
AL	50·6±0·78	3·60±0·54	39·8–61·4	42·0–57·0	7·1
PL	64·3±0·52	2·44±0·37	57·0–71·6	60·0–69·0	3·8
Sens.	77·75±0·67	1·91±0·48	72·0–83·5	75·0–80·0	2·3

TROMBICULA (? LEPTOTROMBIDIUM) VILLOSA sp. n.

Plate 7, fig. A–E.

Description of Larvae. Shape oval. Colour in life orange. Length (partially engorged) to 325μ, width to 208μ. Scutum roughly rectangular, with AL and PL at the anterior and posterior lateral corners, anterior margin lightly concave, posterior margin not very deep behind PL with the median part straight, SB in line with or slightly behind line of PL; sensillae missing in all specimens but probably filamentous. Eyes 2 + 2, on ocular shields, about equal. Chelicerae with only the apical tricuspid cap. Galeal setae feathered or branched. Palpi stout; tibial claw bifurcate; setae on femur, genu and tibia all nude except the dorsal on tibia. Dorsal setae to 58μ long, very numerous, long, slender, tapering and ciliated, more than 100 in number and arranged 2, then ca. 10 rows of ca. 14 setae. Ventrally a pair of ciliated setae on maxillae, each coxae unisetose, a pair of setae between coxae I and between coxae III, and thereafter ca. 100 setae. Legs all 7-segmented; I 312μ long, II 260μ, III 325μ; tarsi I and II with usual dorsal sensory rod, III without any long nude seta.

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	88·5±1·12	2·50±0·79	81·0–96·0	86·8–92·4	2·8
PW	103·0±1·63	3·65±1·15	92·1–113·9	98·0–106·4	3·5
SB	41·2±0·56	1·25±0·40	37·5–44·9	39·2–42·0	3·0
ASB	35·8±0·56	1·25±0·40	32·1–39·5	33·6–36·4	3·5
PSB	13·4±0·56	1·25±0·40	9·7–17·1	11·2–14·0	9·4
SD	49·3±1·12	2·50±0·79	41·8–56·8	44·8–50·4	5·0
A–P	34·7±0·68	1·53±0·48	30·1–39·3	33·6–36·4	4·4
AM	75·6±0·88	1·98±0·63	72·7–78·5	72·8–78·4	2·6
AL	62·2±0·56	1·25±0·40	58·4–66·0	61·6–64·4	2·0
PL	72·0±1·05	2·34±0·74	63·0–81·0	70·0–75·6	3·2
Sens.	No determination. Sensillae lost.				

Loc. and Host. From a rat, Ranikhet, Kumaon Hills, India, 29 Oct. 1946, (S. L. Kalra).

TROMBICULA (? LEPTOTROMBIDIUM) BHIMTALENSIS sp. n.

Plate 7, fig. F–I.

Description of Larvae. Shape oval. Size moderate, length (engorged) 665μ, width 560μ. Scutum rectangular, finely punctate; anterior margin sinuously concave; AM placed well behind line of AL; posterior margin shallow and strongly sinuous; PL setae the longest; sensillae missing but bases about

in line with PL. Eyes 2 + 2, but very indistinct. Chelicerae missing. Galeal setae branched. Palpal claw bifid; setae on palpal femur and genu nude; on tibia dorsal and ventral branched, lateral nude. Dorsal setae ciliated, to 54μ long and arranged 2.10.8.6.4.2. Ventrally with paired setae on maxillae, one on each coxa, a pair between coxae I and between coxae III (all these are missing and only represented by the seta bases), and thereafter ca. 20, to 35μ long. Legs: I 240μ long, II 240μ, III 270μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

Standard Data: AW 70·4, PW 83·2, SB 35·2, ASB 30·0, PSB 12·6, SD 42·6, A–P 28·8, AM 32·0, AL 41·6, PL 48·0, Sens. —.

Loc. and Host. The unique type from a shrew, Bhimtal, Kumaon Hills, India, 10 Oct., 1946 (S. L. Kalra).

Remarks. Can be separated as in the key to species.

TROMBICULA (LEPTOTROMBIDIUM) LONGISETA sp. n.

Trombicula n. sp. "L." Lawrence in MS. 1947, In J. R. Audy, "Scrub Typhus Investigations in S.E. Asia, Pt. III. Appendix 7." AMD. 7. War Office, London.

Plate 8, fig. A–E.

Description of Larvae. Shape broadly oval. Length (unengorged) 285μ, width 185μ. Scutum rectangular, with PL at the postero-lateral corners, and very long, and posterior margin rather shallow behind line of PL and only lightly concave, almost straight medially; surface finely punctate; AM not very much behind line of AL; sensillae filamentous, and ciliated distally with the bases distinctly behind line of PL. Eyes 2 + 2, posterior the smaller. Chelicerae non-serrate, with only the apical tricuspid cap. Galeal setae ciliated. Palpal claw bifurcate; setae on palpal femur and genu nude; on tibia, dorsal ciliated and lateral and ventral nude. Dorsal setae 28, long and tapering, to 70μ, and arranged 2.8.6.6.4.2. Ventrally with the usual pair of ciliated maxillary setae, one on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 28 in number, arranged ca. 10.8.6.4, to 50μ long. Legs all 7-segmented: I 227μ long, II 227μ, III 241μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data derived from 14 specimens, 1 larva from Myitkyina, Burma, 1945 (G. M. Kohls, No. 740), 3 larvae from Imphal, India, 1945 (T. J. Lawrence and K. L. Cockings), and 10 larval pelts recovered from reared nymphs by Cockings (larvae from Imphal, 1945), are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	59·9±0·52	1·96±0·37	54·0–65·8	57·6–64·0	3·3
PW	71·5±0·61	2·30±0·43	64·6–78·4	67·2–76·8	3·2
SB	26·75±0·42	1·59±0·30	22·0–31·5	25·6–28·8	5·9
ASB	32·0	No variation recorded.			
PSB	9·6	No variation recorded.			
SD	41·6	No variation recorded.			
A–P	25·6	No variation recorded.			
AM	55·5±0·98	3·68±0·68	44·5–66·5	51·2–64·0	6·6
AL	55·1±0·60	2·24±0·42	48·4–61·8	51·2–57·6	4·0
PL	108·3±2·14	8·00±1·51	84·3–132·3	96·0–128·0	7·4
Sens.	69·8±0·41	1·23±0·29	66·1–73·5	67·6–70·4	4·7

Remarks. This species might be regarded as only a variant of *deliensis* with very long PL setae. It differs, however, in having the palpal claw only bifurcate.

It is herewith placed in *Leptotrombidium* on the precoxal plates in the reared nymphs, as described elsewhere in this paper.

TROMBICULA (LEPTOTROMBIDIUM) DELIENSIS (Walch 1923).

Trombicula deliensis Walch 1923, Kitasato Archiv. Exper. Med. 5, (3), 63; *idem*, 1923. Tr. Vth. Bien. Congr. Far East. Assoc. Trop. Med., Singapore (1924); Womersley and Heaslip 1943; Tr. Roy. Soc. S. Aust., 67, (1), 87; Womersley 1944, *ibid.*, 68, (1), 90.

Trombicula vanderghinstei Gunther 1940, Proc. Linn. Soc., N. S. Wales, 65, (3–4) 250; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 87.

Trombicula Walchi Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 83; Womersley 1944; *ibid.*, 68, (1), 89.

Plate 6, fig. F–L.

This is a common and widely distributed species ranging from Kashmir and India, south-eastwardly to the Philippines, and from Ceylon south-eastwardly through Burma, Malaya, New Guinea, to the Solomon Islands and Northern Queensland. As a known vector in the transmission of the rickettsia of scrub typhus from rats to man it is of very great importance medically.

From the only other species definitely known as a vector, *T.* (*L.*) *akamushi*, —a species which some recent workers would regard as only a variety of *deliensis*—it differs in the smaller number of dorsal setae, 28 arranged 2.8.6.6.4.2 with only occasionally one more or less on the second or third dorsal

rows. In this arrangement of dorsal setae, *deliensis* agrees with many other species, which can be separated on other morphological characters. In *akamushi* the dorsal setae are more numerous, 32–40 in number, arranged ca. 2.10.8.6.4.2 to 2.10.8.8.6.4.2, with frequent variations. Further the posterior scutal margin is very shallow behind the line of PL and consequently SB lies *distinctly* in front of PL; whereas in *deliensis* SB is not greatly in front of PL, sometimes appearing almost in line, and the posterior scutal margin is deeper and more rounded.

This species has probably been collected more than any other, and I have been able to compare a considerable number of populations from different areas.

Walch in his original description and figures gave very few measurements: The scutum was stated to be 37μ long and 74μ wide; PL was 4μ behind line of SB; AL 39μ; Sens. 61μ. No measurements for the lengths of AM and PL were stated but his figure shows both as longer than AL, and PL as longer than AL.

Of the following twenty-four populations studied, the first twenty-one may be considered as more or less typical *deliensis* only showing differences, sometimes significant between one another, in relative values of the Standard Data.

If anything, there seems to be tendency for the dorsal scutum to be larger as one goes from west to east, the populations from New Guinea and Northern Queensland having somewhat larger Standard Data. The relative proportions of the scutal setae, with AL the shortest and PL the longest remain fairly consistent. Apart from these normal populations, however, the one from Buna, New Guinea, (No. 24) is very significantly different from all the others in the extreme length of the scutal setae especially PL, which reach a mean length of 85μ. In general the dorsal setae in this, as in all populations approximate the PL setae in length. This population is here regarded as a distinct, possibly local, form under the name of *deliensis* form *bunaensis* nov. (plate 6, fig. I–L).

At the other extreme, another small collection of three specimens from Abidari and seven from Buna, N.G. (No. 22) differ from the normal in the very short scutal (and dorsal) setae, with PL being equal to or only slightly longer than AM, with a mean of ca. 40μ. Two other specimens (No. 23) from Bougainville, (G. W. Wharton) are also of this form. Whether these specimens are sufficiently distinct to warrant a form name is doubtful. The two specimens from Bougainville appear to have the palpal claw two-pronged instead of three-pronged as is normal for *deliensis*, although the Buna-Abidari

specimens are apparently three-pronged. This character, however, is sometimes very difficult to be certain about even under high magnification.

The type specimen of *T. walchi* Wom. and Heaslip 1943 from Batavia (re-measured) has the following Standard Data: AW 61·6, PW 75·6, SB 28·0, ASB 28·0, PSB 14·0, SD 42·0, A–P 28·0, AM 50·4, AL 56·4, PL 56·0, Sens. —, and thus cannot be separated from typical *deliensis*.

Gunther's *vanderghinstei* from Bulolo, New Guinea is also a typical *deliensis*.

NUMBER AND LOCALITIES OF POPULATION IN THE FOLLOWING TABLE.

(1) *Ceylon.* Seven specimens from Colombo, 1944 (C. D. Radford) and seven from Embillpitiya, on *Rattus kandiyanus*, 1944 (S. H. Jayewickreme).
(2) *Maldive Is.* Four specimens from *Rattus r. norvegicus*, 1945 (C.D.R.).
(3) *Assam.* Sixteen specimens from *Rattus flavipectus yunnanensis* from 21 mile mark, Stillwell Road, 6/9/45. (R. Traub).
(4) *Manipur.* Three specimens from *Rattus* sp. 9/6/45 (R. Traub).
(5) *Burma.* Eighteen specimens ex Traub. coll. 1945.
(6) *Burma.* Thirty-six specimens ex T. J. Lawrence coll. 1945.
(7) *Malaya.* Twenty-three specimens from *Rattus mulleri* from Kepong, Selangor, F.M.S., June, 1945 (J. R. Audy coll.).
(8) *Malaya.* Eighteen specimens from ground squirrel, Kepong, Selangor, F.M.S., Sept., 1950 (J. R. Audy coll.).
(9) *Malaya.* Fourteen specimens from *Rattus bowersi*, from Ulu Langat, Selangor, F.M.S., June, 1950 (J. R. Audy).
(10) *Malaya.* Eight specimens: one from *Rattus annandalei* from Bukit Langan, F.R., 1949; five from a shrew, Ulu Langat, Dec., 1949, and two from *R. mulleri* from Ulu Langat, Selangor F.M.S. Nov., 1949 (J. R. Audy coll.).
(11) *Borneo.* Seventy-five specimens from *Tragulus javanicus* from Fort Leju, Tinjar, Sarawak, Aug., 1950 (ex J. R. Audy).
(12) *Borneo.* Twenty-one specimens from ears of *Callosciurus hippurus*, Stapok F.R., Kuching, May, 1950 (ex. J. R. Audy).
(13) *Philippines.* Five specimens ex *Rattus* sp. Feb., 1945. (coll. C. Mohr).
(14) *Philippines.* Sixteen specimens ex. *Rattus* sp. from Mercia, Negros, July, 1945 (C. B. Philip coll.).
(15) *Bat. Is., N.G.* Eight specimens on boots Nov., 1949 (coll. G. M. Kohls).
(16) *Solomon Is.* Twenty-four specimens on boots, from Island North of Bougainville, Aug., 1945 (Coll. G. H. McQueen).
(17) *Dutch N.G.* Eighty-five specimens from Sansapore, 1944 (coll. C. Mohr).
(18) *New Guinea.* Fourteen specimens from ears of rat, Milne Bay, Papua, Aug., 1943 (coll. S. L. Allman).
(19) *New Guinea.* Ten specimens from ears of rat, Kerowae, Nov., 1944 (coll. Consett. Davis).
(20) *Australia.* Twenty-eight specimens from rats, from Cairns, N. Queensland, 1939 (G. W. Heaslip).
(21) *Australia.* Six specimens from boots, Bramston's Beach, N. Queensland, Sept., 1949 (coll. I. M. Mackerras).
(22) *New Guinea.* Ten specimens: three from boots, Abidari, July, 1943 (coll. R. N. McCulloch), and seven from boots at Buna, Aug., 1943 (coll. R. N. McCulloch).
(23) *Solomon Is.* Two specimens ex *Rattus praetor* from Jaba River, Sept., 1944 (coll. G. W. Wharton).
(24) *New Guinea.* Twelve specimens: eight from rat, Buna, Dec., 1946 (coll. G. M. Kohls), and four from rat, Buna, Jan., 1944 (coll. Maj. Hicks).

Standard Data of twenty-four populations of *Trombicula* (*Leptotr.*) *deliensis* (Walch.) (showing Means ± 3 times Standard Deviation).

Population	No. of Specimens	AW	PW	SB	ASB	PSB	SD
(1)	14	66·2±5·3	78·2±7·0	30·6±7·0	28·0	14·0	42·0
(2)	4	65·8±8·5	74·9±8·0	29·75±4·0	28·0	14·0	42·0
(3)	16	59·7±4·9	72·8±16·8	28·5±4·2	28·0	14·0	42·0
(4)	3	64·9±6·4	73·7±4·8	30·8	28·0	14·0	42·0
(5)	18	61·0±6·3	72·8±6·8	28·0±4·85	28·0	14·0	42·0
(6)	36	61·0±5·6	72·7±7·5	27·15±5·25	28·0±3·0	11·5±3·0	39·6±3·0
(7)	23	62·2±7·4	70·85±7·2	29·1±4·1	28·25±2·35	13·75±2·35	42·0
(8)	18	59·7±4·9	70·0±4·85	29·7±4·1	25·5±2·65	14·0	39·5±2·65
(9)	14	68·2±8·7	76·6±7·5	32·2±4·2	30·8	11·2	42·0
(10)	8	60·75±6·25	69·65±3·1	28·35±3·1	28·0	14·0	42·0
(11)	75	60·25±4·2	71·8±4·65	28·95±3·45	28·0	14·0	42·0
(12)	21	62·9±6·6	72·25±5·55	29·9±4·7	28·0	14·0	42·0
(13)	5	57·7±4·6	71·1±4·6	25·2	28·0	14·0	42·0
(14)	16	55·65±4·2	67·55±7·05	25·55±2·85	25·2	14·0	39·2
(15)	8	62·3±5·9	73·5±7·4	29·75±4·35	28·0	14·0	42·0
(16)	24	66·15±6·35	77·35±7·6	30·9±3·6	28·0	14·0	42·0
(17)	85	63·55±6·6	72·3±6·9	28·9±4·8	28·0	14·0	42·0
(18)	14	67·0±9·8	81·8±11·6	32·6±5·1	28·0	14·0	42·0
(19)	10	70·0±6·85	81·7±12·4	31·9±9·9	30·8	16·8	47·8
(20)	28	68·2±6·0	81·3±8·25	30·9±5·35	28·0	14·0	42·0
(21)	6	70·5±6·3	83·5±3·4	33·1±3·4	33·1±3·4	16·8	49·9±3·4
(22)	10	64·7±9·2	70·55±12·65	30·25±6·6	26·3±4·3	14·0	40·3±4·3
(23)	2	58·8	70·0, 78·4	28·0, 32·2	28·0	11·2	39·2
(24)	12	70·7±5·9	82·4±5·4	33·1±3·1	31·0±2·3	16·6±2·3	47·6

Standard Data of twenty-four populations of *Trombicula* (*Leptotr.*) *deliensis* (Walch.) (showing Means ± 3 times Standard Deviation).

Population	No. of Specimens	A–P	AM	AL	PL	Sens.
(1)	14	26·2±4·2	50·7±4·75	44·2±7·0	56·85±6·3	70·0
(2)	4	27·3±4·2	53·2±8·4	42·0	56·7±4·2	70·0
(3)	16	29·65±3·95	51·6±4·1	42·4±2·9	55·25±3·7	68·6±8·4
(4)	3	28·9±4·8	56·0	41·9	56·0	70·0
(5)	18	29·25±3·4	55·5±3·3	46·5±4·1	56·3±2·6	69·3±4·2
(6)	36	26·5±4·9	56·2±8·7	49·3±8·0	63·1±13·7	69·6±9·6
(7)	23	27·9±4·6	42·5±4·8	54·4±4·85	52·95±9·85	64·6±11·1
(8)	18	23·95±5·0	48·75±9·6	36·1±9·2	53·7±8·4	63·3±7·5
(9)	14	30·2±3·4	50·15±8·6	52·2±7·5	50·8±6·6	68·1±9·7
(10)	8	25·55±3·1	50·4	45·5±12·5	62·3±15·0	—
(11)	75	28·3±2·6	56·3±5·85	46·4±5·2	59·3±6·7	60·9±3·9
(12)	21	28·9±4·0	49·2±12·5	52·2±6·8	58·55±5·85	70·0
(13)	5	28·0	43·4±4·8	41·4±3·75	58·0±14·7	69·3±6·0
(14)	16	25·2	50·6±4·0	37·35±4·0	54·25±5·2	56·55±5·1
(15)	8	28·0	51·6±6·6	41·6±3·2	51·5±7·5	56·0
(16)	24	28·1±2·95	52·3±8·2	42·5±3·1	54·95±4·35	65·1±10·6
(17)	85	27·8±4·5	52·65±8·55	44·55±6·6	56·9±6·3	70·0
(18)	14	29·6±4·1	53·0±7·4	44·0±7·4	56·15±6·6	70·0
(19)	10	33·0±3·5	59·9±4·6	46·05±7·4	59·0±8·1	63·8±10·9
(20)	28	29·3±4·7	57·5±4·2	46·25±6·35	69·4±11·0	73·5±2·1
(21)	6	31·0±1·7	56·9±8·7	45·7±4·3	68·1±7·4	76·15±5·3
(22)	10	26·6±5·9	40·0±6·5	37·9±6·05	67·7±8·3	71·4±7·0
(23)	2	25·2,78·0	42·0, 44·8	36·4, 39·2	40·0±5·7	55·3±4·2
(24)	12	32·4±4·1	65·5±75·1	54·5±6·6	85·4±9·5	70·55±3·75

TROMBICULA (LEPTOTROMBIDIUM) AKAMUSHI (Brumpt 1910).

Trombicula coarctatum (Berl. 1888), in Kitashima and Miyajima 1918, cited Walch 1923, Tr. Vth. Bien. Congr. Far East. Assoc. Trop. Med. (1924).

Kedania tanakai Kishida 1909, cited Tanaka *et al.*, 1930, Zentralblt. Bakt. Abt. 1, 116. Orig., 353.

Trombidium akamushi Brumpt 1910, Précis de Parasitol., 2nd ed., 506.

Microtrombidium akamushi, Hirst 1915, J. Econ. Biol., 10, 79.

Leptotrombidium akamushi, Nagayo *et al.*, 1917, J. Exper. Med., 25, 255.

Trombicula akamushi, Hirst 1917, Arachnida injurious to Man (B. Mus. N.H.). Econ. Ser., No. 6: Nagayo *et al.*, 1921, Amer. J. Hygiene, 1, (5–6), 569; Walch 1923, Tr. Vth. Bien. Congr. Far East. Assoc. Trop. Med. (1924); Gater 1932, Parasitology, 24; Brumpt 1936, Précis de Parasitol: Womersley and Heaslip, 1943. Tr. Roy. Soc. S. Aust., 67, (1), 84; Sig. Thor and Willmann 1947, Das Tierreich, Lfg.. 71b, 381,.

Microtrombidium brumpti Hirst 1915, J. Econ. Biol., 103; syn. Ewing 1925, Ann. Ent. Soc. Amer., 13, 381.

Trombicula fletcheri Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 86; Womersley 1944, *idem* 68, (1), 89.

Trombicula obscura Womersley 1944, Tr. Roy. Soc. S. Aust., 68, (1), 86.

Plate 6, fig. M–O.

If valid, Kishida's names would replace those of *Leptotrombidium akamushi* Nagayo *et al.*, 1917. Kishida first published his paper privately in 1909, of which only 100 copies are understood to have been distributed. However, in spite of intensive search in America, Britain and elsewhere, my colleague, Dr. C. B. Philip, has been unable to trace anywhere a copy of the original paper. In 1946, Kishida republished his paper, but again privately, although with excellent figures. It appears then that as Kishida's publications are not scientific papers under the International Rules, his names are not valid.

This species is very close to *deliensis* Walch and has been considered by some workers to be the same, differing only in the larger number of dorsal setae which vary from 32 to 40 in number, as against an almost constant 28 in *deliensis.* It is, however, not only distinct in this character but is distinguished by the longer A–P, bringing the sensillae bases (SB) much more in advance of line of PL, and the posterior margin being straighter, although lightly sinuous, and shallower behind PL.

In the typical form from Japan, as shown in Kishida's 1946 figure and in the works of other Japanese authors, as well as the Japanese material studied by the writer, the dorsal setae appear to be somewhat variable from 32–40 in number. Kishida, 1946, shows them as 2.8.6.8.6.4.= 34, whilst Hirst 1915 shows them as 2.8.6.10.8.4.2 = 40. The arrangement on the first 3 rows, however, appears fairly constant, the variation occurring on the posterior rows. Here, however, it is sometimes difficult to place some of the lateral posterior setae as belonging to the dorsal or ventral surface.

In a moderately large population from Bagabag, Luzon, in the Philippines, collected by C. B. Philip, 1945, the dorsal setae vary from 32 to 39, mainly arranged 2.8.8.8.6.4.3 = 38, but varying from 2.8.4.8.6.4 =32 to 2.9.8.8.6.4.2 = 39.

In 1943, Womersley and Heaslip described *fletcheri* from Malaya mainly on the different arrangement and number of dorsal setae, viz. 2.10.8.6.4.2.2=34. Recently a large population, collected by Dr. J. R. Audy 1945, from various hosts in the neighbourhood of Sungei Buloh, F.M.S., has been studied, in which the dorsal setae varied from 2.10.8.6.4.2 = 32 to 2.11.8.6.6.4.2 =39, but mainly were 2.10.8.6.6.4.2 = 38.

Similarly populations from Owi Island, Dutch New Guinea, as well as parts of New Guinea, agree in having the dorsal setae ca. 38 in number and arranged generally 2.10.8.8.6.4. This difference from the normal Japanese form perhaps justifies the retention of the name *fletcheri* as a geographical one.

The Standard Data expressed by the Mean ± 3 times the Standard Deviation, for the following populations are given in the succeeding table.

NUMBER AND LOCALITIES OF POPULATION IN THE FOLLOWING TABLE.

(1) *Japan.* 11 specimens: some from Dr. Mitamura's original collection and some collected at Niigata, Yamagata Prefecture, by Dr. C. B. Philip in 1945.
(2) *Philippines.* 25 specimens from Bagabag, Luzon, Aug., 1945 (coll. C. B. P.).
(3) *Philippines.* 13 specimens from rats, precise locality ?, 1945 (coll. C. Mohr.).
(4) *New Guinea.* 14 specimens from *Rattus mordax,* No. 467. Buna area, 1944 (coll. G. M. Kohls.).
(5) *New Guinea.* 11 specimens from *Rattus mordax,* No. 475. Buna area, 1944 (coll. G.M.K.).
(6) *New Guinea.* 12 specimens from boots, Dumpu, 1943 (coll. R. N. McCulloch).
(7) *New Guinea.* 21 specimens from *Echymipera cockerelli* from Dobodura area (coll. G.M.K.).
(8) *New Guinea.* 10 specimens from rats, Buna, 1944 (coll. Maj. Hicks).
(9) *Dutch New Guinea.* 14 specimens, 1944 (coll. C.B.P.).
(10) *Malaya.* 125 specimens from Sungei Buloh, etc., 1948 (coll. J. R. Audy).

Standard Data of ten populations of *Trombicula* (*Leptotr*) *akamushi* (Brumpt.) (showing Means ± 3 times Standard Deviation).

Population	No. of Specimens	AW	PW	SB	ASB	PSB
(1)	11	65·5±5·4	74·5±5·1	29·8±7·2	27·0	13·2±3·5
(2)	25	57·7±4·6	66·9±4·5	27·0	21·0	12·0
(3)	13	55·85±3·65	69·85±3·65	24·85±2·7	24·0	13·0
(4)	11	58·4±4·7	65·2±4·1	26·4±4·9	24·0	12·7±3·0
(5)	13	63·9±9·2	77·8±7·8	32·1±5·7	27·0	12·5±3·4
(6)	12	54·8±4·0	60·25±4·65	26·0±3·4	24·75±3·4	12·3±2·65
(7)	21	66·75±8·4	81·75±13·2	34·1±6·2	26·5±3·2	13·2±3·5
(8)	10	60·5±4·6	68·2±6·9	28·65±3·0	—	—
(9)	14	65·65±4·5	75·3±8·1	30·9±4·1	27·0	14·15±3·7
(10)	125	68·7±6·3	81·1±8·3	33·4±5·0	26·15±3·95	16·65±1·8

Population	No. of Specimens	SD	A–P	AM	AL	PL	Sens.
(1)	11	40·2±3·5	28·7±3·8	53·6±6·4	42·3±7·5	57·1±6·8	61·2±4·9
(2)	25	33·0	24·0	50·15±5·8	37·8±4·5	52·7±4·8	59·3±3·0
(3)	13	37·0	27·9±3·1	50·2±7·6	39·6±3·8	52·45±5·15	53·55±6·9
(4)	11	36·7±3·0	26·45±3·65	50·7±7·9	40·9±5·6	49·4±7·4	60·0
(5)	13	39·5±3·4	27·0	52·45±6·9	39·7±3·3	51·7±7·5	60·0
(6)	12	37·1±3·7	24·0	43·6±5·6	38·6±4·8	45·5±5·2	53·7±2·9
(7)	21	39·7±3·2	26·8±3·6	55·3±7·7	39·6±3·9	53·7±6·8	64·9±4·7
(8)	10	38·5±8·7	26·7±7·9	43·1±10·6	35·0±4·6	42·4±12·2	60·3±6·1
(9)	14	41·15±3·7	28·1±4·5	54·9±8·1	40·0±3·8	55·4±7·7	65·7±7·5
(10)	125	42·8±3·9	28·15±4·3	52·4±8·1	42·6±8·3	53·8±7·4	64·25±11·05

Trombicula obscura Womersley 1944 cannot be separated from, and is now regarded as being, the usual New Guinea form of *akamushi*, with the 38 dorsal setae arranged 2.8.8.8.6.4.2, and the scutal setae somewhat longer than normal, but not outside of the theoretical range. It was described from the type and 3 paratypes, from Milne Bay, N.G. The population collected by Maj. Hicks from Buna must also be referred to *akamushi* f. *fletcheri*. (The Standard Data are given under No. 8 in the above table).

TROMBICULA (LEPTOTROMBIDIUM) FULLERI (Ewing 1945).

Trombicula fulleri Ewing 1945, Proc. Ent. Soc., Washintgon, 47, (3), 46.

Plate 8, fig. F–J.

Redescription of Larvae. Shape oval. Length (engorged) to 710μ, width to 500μ. Scutum rectangular, with PL at the posterior lateral corners, and the posterior margin only moderately deep behind PL but strongly sinuous and concave medially; PL setae the longest; sensillae filamentous and ciliated distally, with the bases only slightly behind line of PL. Eyes 2 + 2, posterior the smaller. Chelicerae normal, non-serrate and with only the apical tricuspid

cap. Galeal setae ciliated. Palpi claw trifurcate; setae on palpal femur and genu nude; on tibia, dorsal ciliated, lateral and ventral nude. Dorsal setae 28, to 52μ, arranged ca. 2.8(10).6(4).6.4.2. Ventrally with the usual pair of ciliated maxillary setae, one on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 20 to 32μ long. Legs all 7-segmented: I 225μ long, II 227μ, III 260μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data derived from 3 larvae and 8 larval pelts from reared nymphs (K. L. Cockings), all from Imphal, India, 1945, are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	56·6±0·39	1·29±0·28	52·7–60·5	54·4–57·6	2·3
PW	65·0±0·45	1·49±0·32	60·6–69·4	64·0–67·2	2·3
SB	25·95±0·30	0·98±0·21	23·0–28·9	25·6–28·8	3·8
ASB	27·0±0·59	1·97±0·41	21·1–32·9	22·4–28·8	7·3
PSB	10·8±0·38	1·26±0·27	7·0–14·6	9·6–12·8	11·6
SD	37·75±0·55	1·82±0·39	32·3–43·2	35·2–41·6	4·8
A–P	22·7±0·51	1·70±0·36	17·6–27·8	19·2–25·6	7·5
AM	42·25±0·37	1·12±0·26	38·9–45·6	41·6–44·8	2·6
AL	35·65±0·38	1·12±0·24	32·3–39·0	35·0–38·0	3·1
PL	62·6±0·70	2·34±0·50	55·6–69·6	57·6–65·8	3·7
Sens.	55·0±0·89	2·19±0·63	48·4–61·6	51·2–57·6	4·0

Remarks. In the dorsal setae and the setation of the palpi this species is close to *deliensis*, but it differs in the sinuation of the posterior scutal margin. It is here placed in *Leptotrombidium* on the presence of precoxal plates on coxae I in the nymphs reared by Mr. Cockings, and described elsewhere in this paper.

A further collection of larvae of this species made by Major R. Traub from Burma has been examined, which show a significantly larger scutum than those quoted above, although they do not differ in any morphological character. The Standard Data for 13 of these specimens are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	62·25±0·81	2·94±0·57	56·45–68·05	58·8–67·2	4·7
PW	72·4±0·60	2·15±0·42	65·95–78·85	70·0–75·6	3·0
SB	28·85±0·36	1·29±0·25	25·0–32·7	28·0–30·8	4·5
ASB	28·0	No variation recorded.			
PSB	11·2	No variation recorded.			
SD	39·2	No variation recorded.			
A–P	23·7±0·39	1·39±0·27	19·5–27·9	22·4–25·2	5·9
AM	46·2±0·40	1·40±0·28	42·0–50·4	44·8–47·6	3·0
AL	41·8±0·52	1·79±0·36	36·4–47·2	39·2–44·8	4·3
PL	69·35±0·54	1·95±0·38	63·5–75·2	64·4–72·8	2·8
Sens.	to 64·4				

In correspondence, Dr. Fuller informs me that he has examined Ewing's co-types of *fulleri* and compared them with an authentic specimen of *deliensis* Walch from Sumatra, and that Ewing's figure erroneously shows the sensillae bases as anterior of line of PL whereas they are actually posterior thereof. Dr. Fuller's specimens from Burma agreed in this respect with the co-types of *fulleri* Ewing and are considered to be the same species. I have also examined another lot from Burma collected at the same time and am in agreement with Fuller that they are not *deliensis* Walch. However, besides differing in having SB posterior of PL, there is a marked difference in the curvature of the posterior scutal margin. In all the material of *deliensis* I have examined from many localities this margin is more or less an even curve, whereas in *fulleri* it is sinuous and medially concave. In this respect also Ewing's figure is erroneous.

TROMBICULA (LEPTOTROMBIDIUM) MYZANTHA sp. n.

Trombicula sp. Gill, Moule and Riek., 1925, Aust. Vet. J., 32, fig. 9 (3).

Plate 9, fig. A–C.

Description of Larvae. Shape ovate. Length 375μ, width 270μ. Dorsal scutum more or less rectangular, with the anterior margin concave except medially, and posterior margin shallowly convex with the median part flattened and not sinuous; surface coarsely punctate and with a pair of distinct oval discs near anterior margin. Eyes 2 + 2, on distinct ocular shields, the posterior eyes the smaller. Chelicerae 44μ long and with only the usual apical tricuspid cap. Galeal setae nude. Palpi stout, femur and genu with a long curved strongly strongly ciliated setae; tibia with all 3 setae nude; tarsi with the usual basal rod, and 5 or 6 ciliated setae, one being much stronger and longer than the others and over-reaching tip of palpal claw; palpal claw trifurcate, the median prong the longest. Dorsum with 28 rather blunt-tipped ciliated setae, to 42μ long and arranged 2.8.6.6.4.2. Ventrally with the usual pair of curved branched maxillary setae; a single seta on each coxa; a pair between coxae I and between coxae III, and thereafter 6.4.4.4.2.2 = 22 all more slender than the dorsal setae, to 45μ long. Legs: I 370μ long, II 330μ, III 405μ; tarsi I and II with the usual dorsal rod-like setae, which are relatively short, ca. 1/6 length of tarsus; no long nude outstanding seta on tarsi III.

The Standard Data for the type, and 15 paratypes from Queensland are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	74·8±0·49	1·97±0·35	68·9–80·7	72·0–78·0	2·6
PW	85·0±0·46	1·85±0·33	79·4–90·6	82·0–87·0	2·2
SB	25·5±0·41	1·66±0·29	20·5–30·5	22·0–27·0	6·1
ASB	29·0±0·35	1·39±0·25	24·8–33·2	27·0–30·0	4·8
PSB	17·6±0·21	0·86±0·15	14·95–20·25	15·0–18·0	4·9
SD	46·5±0·42	1·69±0·30	41·4–51·6	43·0–48·0	3·6
A–P	29·7±0·33	1·31±0·23	25·8–33·6	27·0–33·0	4·4
AM	31·9±0·38	1·44±0·27	27·6–36·2	30·0–42·0	4·5
AL	39·6±0·50	1·96±0·36	33·7–45·5	36·0–42·0	5·0
PL	53·8±0·81	3·12±0·57	44·4–63·2	51·0–60·0	5·8
Scns.	45·25±0·55	1·92±0·31	39·5–51·0	42·0–48·0	4·2

Loc. The type from a pallid cuckoo, Clermont, Queensland, 4 Nov. 1944 (D. A. Gill) and 15 paratypes from a "Lousy Jack", Logan Downs, Clermont, 28 Nov., 1944 (D.A.G.).

Remarks. In their interesting paper, "Trombidiosis of Sheep in Queensland," Aust. Vet. J., 1945, 22, the authors, Messrs. D. A. Gill, G. R. Moule and R. F. Riek, state that this species, therein referred to as new but unnamed species of *Trombicula,* was common on a number of other birds, the names of which are given.

In that paper an exceptionally fine microphotograph of the dorsal scutum, as obtained by a new technique developed by Mr. Parrish of the McMaster Laboratory, is published.

As stated above, *myzantha* is very closely related to the preceding species, in having the same number of dorsal and ventral setae, although the disposition in the anterior rows differs. The DS are longer and the dimensions of the dorsal scutum greater in *myzantha,* but with further material, the two species may possibly be shown to be synonymous.

Also 9 specimens from a "fruit pigeon" from Owi Island, Dutch N. Guinea, 13 Oct. 1944 (D. E. Howell) and 22 specimens from "pigeon" from a small island off the north of Bougainville, Aug., 1945 (G. H. McQueen).

In both these populations the Standard Data are very significantly lower than those of the Queensland population, while they are also significantly different between themselves.

For these island populations the form names *T.* (*?L.*) *myzantha* f. *owiensis* and *T.* (*? L.*) *myzantha* f. *bougainvillensis* are proposed.

The Standard Data are as follows:

Owi Island Population.

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	63·0±0·71	2·12±0·50	56·7–69·3	60·0–66·0	3·4
PW	69·45±0·78	2·35±0·55	62·4–76·5	66·0–72·0	3·4
SB	21·2±0·22	0·67±0·16	19·2–23·2	21·0–23·0	3·1
ASB	27·0	No variation recorded.			
PSB	17·3±0·44	1·32±0·31	13·4–21·2	15·0–18·0	7·6
SD	44·3±0·44	1·32±0·31	40·4–48·2	42·0–45·0	3·0
A–P	27·7±0·44	1·32±0·31	23·8–31·6	27·0–30·0	4·8
AM	26·3±0·44	1·32±0·31	22·4–30·2	24·0–27·0	5·0
AL	35·3±0·44	1·32±0·31	31·4–39·2	33·0–36·0	3·7
PL	45·0±0·50	1·50±0·35	40·5–49·5	42·0–48·0	3·3
Sens.	45·75±1·43	2·87±1·01	35·15–54·35	42·0–48·0	6·2

Bougainville Population.

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	66·7±0·54	1·79±0·38	61·3–72·1	63·0–69·0	2·6
PW	72·6±0·58	1·92±0·41	66·8–78·4	69·0–75·0	2·6
SB	22·6±0·39	1·30±0·28	18·7–26·5	21·0–24·0	5·7
ASB	27·9±0·43	1·37±0·31	23·8–32·0	27·0–30·0	4·0
PSB	16·4±0·45	1·49±0·32	11·9–20·9	15·0–18·0	9·0
SD	44·1±0·43	1·37±0·31	40·8–48·2	42·0–45·0	3·1
A–P	28·1±0·43	1·44±0·31	23·8–32·4	27·0–30·0	5·1
AM	29·25±0·75	2·12±0·53	22·9–35·6	27·0–33·0	7·2
AL	37·45±0·62	2·06±0·44	31·3–43·6	33·0–40·0	5·5
PL	46·0±0·64	2·13±0·45	39·6–52·4	42·0–50·0	4·6
Sens.	46·1±0·55	1·55±0·39	41·4–50·8	45·0–48·0	3·4

TROMBICULA (? LEPTOTROMBIDIUM) ROBUSTA Gunther 1941.

Proc. Linn. Soc. N.S.W., 66, (3–4), 157, 1941, fig. 1–5; Womersley and Heaslip, Tr. Roy. Soc. S. Aust., 67, (1), 85, 1943.

Plate 9, fig. D–F.

This species was originally described from colonies on the legs of *Pitta mackloti* Temminck and of *Microeca* sp., from Bulolo, N. Guinea. To it are now referred two specimens from the ears of a "thrush-like bird" from Hollandia, Dutch N. Guinea, 10 Dec., 1944 (C.B.P.).

The dorsal scutum is as figured, approximately rectangular, with the posterior margin very shallow behind PL and medially sinuate; PW only a little greater than AW, and SB much nearer to PL than to AL but anterior of PL; the surface coarsely pitted, and near to anterior margin a pair of oval discs; scutal setae more or less subequal. Chelicerae with only the apical tricuspid cap. Galeal setae nude. Palpal claw trifurcate; setae on femur and

genu branched; on tibia all 3 nude (Gunther states "two nude setae near the base and one with very short branches half-way"). DS 34, arranged 2.12.8.6.4.2, to 50μ long. No long nude seta on tarsi of leg III. Body cordate and overlapping mouth parts.

The Standard Data derived from the type and 2 paratypes, and 2 specimens from Hollandia are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	72·6±0·60	1·34±0·42	68·6–76·6	72·0–75·0	1·8
PW	78·0±0·95	2·12±0·68	71·7–84·3	75·0–81·0	2·8
SB	24·0	No variation recorded.			
ASB	32·4±0·60	1·34±0·42	28·4–36·4	30·0–33·0	4·1
PSB	15·0	No variation recorded.			
SD	46·8±0·73	1·64±0·52	41·9–51·7	45·0–48·0	3·5
A–P	30·6±0·60	1·34±0·42	26·6–34·6	30·0–33·0	4·4
AM	42·0	Only one determination.			
AL	47·4±0·60	1·34±0·42	43·4–51·4	45·0–48·0	4·1
PL	52·8±0·73	1·64±0·52	47·9–57·7	51·0–54·0	3·1
Sens.	50·0	No variation recorded.			

Along with *T.* (*L.*) *myzantha* sp. n. and *T. philipi* sp. n., this species forms a small group of closely allied species in having the pair of anterior scutal discs.

TROMBICULA (LEPTOTROMBIDIUM) BURMENSIS (Ewing 1945).

Trombicula burmensis Ewing 1945. Proc. Ent. Soc. Washington, 47, (3), 63.

Plate 9, fig. G–K.

This species was somewhat inadequately described from larvae from specimens from Ting Hawk, June, 1944, and Shaduzup, July, 1944, in Burma (coll. H. S. Fuller). I have been able to study five specimens of this species collected by T. J. Lawrence and K. L. Cockings, from *Rattus rattus bruneusculus* from Imphal, India, Sept. and Oct., 1945, from which the following redescription is drawn. Three of these specimens were larval pelts recovered from the reared nymphs by K. L. Cockings.

Redescription of Larvae. Shape oval. Length (unengorged) 290μ, width 227μ (well engorged, according to Ewing, *loc. cit.*, 830μ and 440μ). Scutum rectangular, finely punctate, with the posterior angles well rounded, and the PL setae placed not quite midway between posterior margin and AL, i.e. PL are not at the postero-lateral corners; AM placed well back from line of AL; sensillae filamentous, with short barbs basally and longer ciliations distally, their bases slightly behind line of PL. Eyes 2 + 2, posterior the smaller. Chelicerae

non-serrate, with only the apical tricuspid cap. Galeal setae strongly ciliated. Palpal claw trifurcate; setae on palpal femur and genu ciliated; on tibia dorsal ciliated, lateral and ventral nude. Dorsal setae 28, to 64μ long, and arranged 2.8.6.6.4.2. Ventrally with the usual pair of ciliated maxillary setae, one on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 26 arranged ca. 12.6.4.2.2. Legs all 7-segmented; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for the above 5 specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	70·4	No variation recorded.			
PW	78·9±1·42	3·18±1·00	69·4–88·4	76·8–84·0	4·0
SB	33·5±0·61	1·36±0·43	29·4–37·6	32·0–35·2	4·0
ASB	31·4±0·64	1·43±0·45	27·1–35·7	28·8–32·0	4·5
PSB	14·7±0·32	0·71±0·23	12·6–16·8	14·4–16·0	4·3
SD	46·1±0·78	1·75±0·55	40·9–51·3	43·2–48·0	3·8
A–P	27·2±0·71	1·60±0·51	22·4–32·0	25·6–28·8	5·9
AM	59·5±1·26	2·82±0·89	51·0–68·0	57·6–64·0	4·7
AL	46·7±0·78	1·75±0·55	41·5–51·9	44·8–48·0	3·7
PL	71·0±0·64	1·43±0·45	66·7–75·4	70·4–73·6	2·0
Sens.	70·4	No variation recorded.			

Remarks. This species is placed in *Leptotrombidium* on the character of precoxal plates on coxae I of the nymphs, reared by Cockings and correlated with the larval pelts. In the shape of the dorsal scutum and the position of PL it is closely related to the *palpalis* group, but differs in having the setae on the palpal femur and genu strongly ciliated.

TROMBICULA (NEOTROMBICULA) FORDI sp. n. Lawrence, T. J. in MS.

Gen. nov. species "FD." Lawrence in MS. In Audy 1947, "Scrub Typhus Investigations in S.E. Asia, Pt. III. Appendix 7." AMD. 7. War Office, London.

Plate 11, fig. A–F.

Description of Larvae. Shape oval. Colour in life unknown. Length (partially engorged) to 325μ, width to 225μ. Dorsal scutum rectangular, pitted, with PL foliate and nearer to AL than to posterior margin, posterior corners rounded; AM and AL normally ciliated, AM well back from anterior margin; sensillae fairly wide apart, filamentous and ciliated on distal half, their bases well behind line of PL. Eyes 2 + 2, small, a little distance from scutum and apparently not on ocular shields. Chelicerae not serrate, with only the usual apical tricuspid cap. Galeal setae strongly branched. Palpi stout, tibial claw

bifid; setae on palpal femur, genu and lateral and ventral on tibia nude, dorsal on tibia strongly branched. All dorsal setae, like PL, foliate, with the lateral margins curled in and with a double fringe of strong setules, (the appearance at first glance suggests the setae are bifid, but this is not so), 48 in number and arranged 2.10.8.8.8.6.4.2, but rows 2 and 3 variable, to 42μ long. Ventrally the setae are slender and ciliated, a pair on maxillae, one on each coxae, a pair between coxae I and between coxae III, and then ca. 10.8.8, followed by ca. 6.4.2. which are foliate similar to the dorsal setae, to 30μ long. Legs all 7-segmented; I 225μ long, II 208μ, III 260μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data derived from the type, 6 paratypes and 2 larval pelts from nymphs reared by K. L. Cockings are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	75·0±1·08	3·24±0·76	65·3–84·7	70·4–80·0	4·3
PW	84·3±1·09	3·58±0·84	73·6–95·0	80·0–89·6	3·9
SB	37·3±0·71	2·12±0·50	31·0–43·6	35·2–41·6	5·6
ASB	30·4±0·53	1·60±0·38	25·6–35·2	28·8–32·0	5·2
PSB	16·0	No variation recorded.			
SD	46·4±0·53	1·60±0·38	41·6–51·2	44·8–48·0	3·4
A–P	19·55±0·69	2·08±0·49	13·3–25·8	16·0–22·4	10·6
AM	44·8±1·43	3·20±1·01	35·2–54·4	41·6–48·0	7·1
AL	43·6±0·58	1·66±0·41	38·6–48·6	41·6–48·0	3·8
PL	48·9±0·91	2·42±0·65	41·7–56·1	44·8–51·2	4·9
Sens.	60·8. Average of two determinations of 57·6 and 64·0.				

Loc. and Hosts. Type host, *Rattus rattus brunneusculus* Hodgson, from Imphal, Manipur State, India 1945. Paratypes from same locality, hosts, and date.

The type host was a "Black Rat with gray belly. *Rattus* sp."

In Lawrence's MS. this species is stated to be fairly common and distributed over a wide area from Imphal down to South Burma. As many as 500 were taken from a single host. Other hosts were the tree shrew *Tupaia belangeri belangeri* Wagner, and the common musk shrew *Scincus caerulus fulvocinereus* Anderson, both of these from Kanglatongbi, Dec., 1945.

Type and paratype in British Museum, paratype in U.S. Nat. Mus., and King Edward VII College of Medicine, Singapore.

TROMBICULA (NEOTROMBICULA) TRAUBI sp. n.

Gen. nov. species "A." Lawrence, T. J. in MS. In Audy 1947. "Scrub Typhus Investigations in S.E. Asia, Pt. III. Appendix 7." AMD. 7. War Office, London.

Plate 11, fig. G–K.

Description of Larvae. Shape oval. Colour in life unknown. Length (somewhat engorged) 481μ, width 350μ. Scutum rectangular, with SB behind line of PL; PL about midway between AL and posterior margin; AM moderately well behind line of AL; both AM and AL normally ciliated, PL foliate, with the lateral margins incurled and bearing a double fringe of setules as in preceding species; sensillae missing but probably filamentous and distally ciliated. Eyes 2 + 2, small, and apparently not on ocular shields. Chelicerae not serrate, with only the apical tricuspid cap. Galeal setae strongly branched. Palpi stout, tibial claw trifurcate; setae on palpal femur and genu, and laterally and ventrally on tibia nude, dorsally on tibia branched. Dorsal setae foliate as in preceding species, but shorter to 30μ and with fewer setules, 52 in number and arranged ca. 2.10.10.10.8.6.4.2. Ventrally with a pair of ciliated setae on maxillae, a pair of slender ciliated setae between coxae I and between coxae III, one on each coxa, and behind coxae III with ca. 8.8.10.8, followed by 8.6.4.2. foliate setae similar to dorsal setae. Legs all 7-segmented; I 546μ long, II 430μ, III 460μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data of the type are: AW 64·4, PW 75·6, SB 33·6, ASB 28·0, PSB 15·4, SD 43·4, A–P 22·4, AM 42·0, AL 39·2, PL 36·4, Sens. 60·0.

Loc. and Host. The type specimen from *Macacus assamensis,* from Imphal, India, August 1945 (T. J. Lawrence).

I have also seen three other specimens, in the collection of C. D. Radford.

The type specimen has very unfortunately become badly damaged, by using oil immersion to determine details of the palpal setae.

Remarks. This species in the structure of the dorsal setae and the shape of the dorsal scutum, is very close to the preceding species *T.* (*N.*) *fordi* sp. n., but appears to be distinct in the smaller scutum, and the dorsal setae being more numerous and shorter with fewer lateral setules.

TROMBICULA (NEOTROMBICULA) HASTATA (Gater 1932).

Trombicula hastata Gater 1932, Parasitology, 24, 151.

Neoschöngastia hastata, Womersley and Heaslip 1943. Tr. Roy. Soc. S. Aust., 67, (1), 116.

Plate 12, fig. A–E.

This species was described from the type and two paratypes from *Rattus surifer surifer* (Miller) from Sungei Buloh, Selangor, Federated Malay States. It was later, despite the absence of the sensillae, referred to the genus *Neoschön-*

gastia, as then understood, by Womersley and Heaslip (1943), rather than to the genus *Trombicula.*

Until recently no further material has been collected since the original discovery.

Gater's description is as follows: "Body ovoid, rounded; striations moderate, slightly crenulated; pitting on scutum, epistome and legs. Fangs of chelicerae moderately stout, slightly curved, abruptly tapering to a sharp point which appears to set at an angle; dorso-apical and ventral teeth apparently absent; maxillary setae strongly pectinate. Palpi rounded; first and second palpal setae short, plain; on fourth segment the dorsal seta with a few short barbs, the other two plain; appendiculum with six pectinate setae; palpal claw long, trifurcate, the upper accessory prong longer than the lower. Scutum broader than long (mean L 44μ, W 71μ; pseudostigmatic organs 37μ apart), trapezoidal, anterior margin concave, posterior margin slightly concave, corners rounded; scutal setae five in number, median anterior small, lanceolate and placed well back from margin; anterior laterals short, stout, strongly pectinate; situated on corners; posterior laterals large, lanceolate and situated under two-thirds the length of scutum fom anterior pair. Pseudostigmata behind posetrior lateral setae, as far in front of the posterior margin of the scutum as the distance between anterior and posterior lateral setae, pseudostigmatic organs missing in these specimens. Body setae large, forty-eight in number; on dorsum thirty, large, translucent, lanceolate, covered with minute hairs, becoming smaller posteriorly, but two pairs of the usual type of body seta, stout, minutely pilose, on posterior edge of body; on venter of the usual type, strongly serrate to pectinate, much longer posteriorly than anteriorly. Foreleg, mean L 157μ; leg setae mostly serrate or pectinate with a few plain; coxal setae single, serrate or strongly pectinate, the one on the midcoxa the shortest. Length (partially engorged) 0·42–0·46 mm.; width 0·26–0·35 mm."

In 1943 Womersley and Heaslip interpolated the Standard Data from Gater's figure and data as follows: AW 69·0, PW 71·0, SB 37·0, ASB 29·0, PSB 15·0, SD 44·0, A–P 15·0, AM 30·0, AL 32·0, PL 42·0, Sens. —.

The "Maxillary setae" in the above description are the galeal setae of present day workers.

The dorsal setae are arranged 2.8.6.6.4.2.2 and the ventral setae posterior of coxae III, 2.6.4.4.4.

Recently I have received from Dr. J. R. Audy a paratype of Gater's material from the I.M.R., Kuala Lumpur, as well as three specimens collected at

Bukit Lagon Forest Reserve, Kuala Lumpur, 1949–50, and one collected on *Rattus subanus,* same locality 1949, which possessed long filamentous sensillae.

From these 5 specimens the Standard Data are somewhat lower than the values interpolated from Gater's figures by Womersley and Heaslip 1943, and are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	59·4±0·56	1·25±0·39	55·6–63·2	58·8–61·6	2·1
PW	64·4	No variation recorded.			
SB	36·4	No variation recorded.			
ASB	28·6±0·56	1·25±0·39	24·8–32·4	28·0–30·8	4·3
PSB	14·0	No variation recorded.			
SD	42·6±0·56	1·25±0·39	38·8–46·4	42·0–44·8	2·9
A–P	12·4±0·40	0·89±0·28	9·7–15·1	12·0–14·0	7·2
AM	30·8	No variation recorded.			
AL	30·8	No variation recorded.			
PL	58·2±0·56	1·25±0·39	54·4–62·0	56·0–58·8	2·1
Sens.	70·0	Only 1 determination.			

TROMBICULA NOVAE-HOLLANDIAE Hirst 1929.

Trombicula novae-hollandiae Hirst 1929. Proc. Zool. Soc. London, 172; Womersley 1934, Rec. S. Aust. Mus., 5, (2), 213; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 95; Sig Thor and Willmann 1947, Das Tierreich, Lfg., 71b, 270.

Plate 12, fig. F–I.

This species was originally described from the ears of *Rattus greyi* from D'Estree Bay, Kangaroo Is., S. Aust., and Womersley and Heaslip 1943, recorded it from *Potorus tridactylus* from Bothwell, Tas. (Coll. H. H. Finlayson), as well as from Cairns, Queensland (host ?).

The scutum is comparatively large and rectangular, but the posterior margin evenly rounded, and SB about in line with PL. Chelicerae simple with only the apical tricuspid cap. Galeal setae nude. All setae on palpal femur, genu and tibia branched; tibial claw trifurcate. Dorsal setae 26 in number, from 80·0 to 50·0μ long, and arranged 2.6.6.6.4.2. Tarsi of leg III with 2 long, nude, outstanding setae; metatarsi of leg III with 1 such seta.

The Standard Data for the type and 2 paratypes from Kangaroo Is., 3 specimens from Cairns, 12 from Tasmania and 2 from Loc. ? are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	70·65±0·55	2·48±0·39	63·2–78·1	66·0–75·0	3·5
PW	93·9±0·67	3·01±0·48	84·9–102·9	87·0–99·0	3·2
SB	30·3±0·42	1·87±0·29	24·7–35·9	27·0–33·0	6·2
ASB	36·15±0·23	1·01±0·16	33·1–39·2	33·0–38·0	2·8
PSB	26·65±0·27	1·19±0·19	23·05–30·25	24·0–29·0	4·5
SD	62·65±0·41	1·82±0·29	57·2–68·1	60·0–67·0	2·9
A–P	33·6±0·50	2·24±0·35	26·85–40·35	27·0–36·0	6·6
AM	55·2±0·75	2·99±0·53	46·2–64·2	48·0–63·0	5·4
AL	50·4±0·50	1·85±0·32	44·85–55·95	48·0–54·0	3·6
PL	66·85±1·07	4·68±0·76	52·8–80·9	60·0–78·0	7·0
Sens.	95·8±1·27	3·12±0·90	86·4–105·2	90·0–99·0	3·3

Remarks. A very characteristic species on the shape and dimensions of scutum, the dorsal setae, and the long nude setae on metatarsi and tarsi III, and separated as in the key to species.

TROMBICULA (NEOTROMBICULA) RARA (Walch 1923).

Trombicula rara Walch 1923. Tr. Vth. Bien. Cong. Far East. Assoc. Trop. Med., Singapore (1924); Womersley and Heaslip 1943. Tr. Roy. Soc. S. Aust., 67, (1), 90.

Trombicula (*Eutrombicula*) *rara*, Sig Thor and Willmann 1947, Das Tierreich Lfg. 71b, 283.

Plate 13, fig. A–D.

This species was originally described by Walch from 4 specimens taken from man in Deli, Sumatra. Womersley and Heaslip 1943 recorded a specimen sent to them by Dr. J. E. Dinger of the Koningen Wilhelmina Institute v. Bactereologie, Batavia as this species, but a re-examination of the specimen shows this determination to be in error, the species being *T. hirsti* Sambon.

From Walch's original data and figures, Womersley and Heaslip 1943 computed the Standard Data as follows: AW 85·0, PW 104·0, SB 54·0, ASB 25·0, PSB 49·0, SD 74·0, A–P 40·0, AM 40·0, AL 33·0, PL 40·0, Sens. 57·0, DS to 34·0.

The following material has been studied and is referred to this characteristic species:

27 specimens from a "small plain skink," Mts. near San Juan, Mindoro, Philippine Is., April 11, 1945 (C.B.P.).

4 Specimens from Hollandia, Dutch New Guinea (2 on a skink, 2 collected on boots), Dec. 8, 1944 (C.B.P.).

3 specimens from a skink *Lygosoma* (*Leiolopisma*) *rhomboidalis* Peters from Lake Eacham, N. Queensland, 10 Sept., 1945 (R.V.S.).

14 specimens from a pill-millipede (*Zephronia* sp.) from Kepong Forest Reserve, Kuala Lumpur, 1948 (J. R. Audy).

From this material the following redescription is drawn:

Larvae. Shape a rather broad oval. Length (unengorged) 240μ, width 180μ . Scutum large, almost quadrate, with the sensillae bases placed very much nearer to AL than to PL and widely separated. Eyes 2 + 2. Chelicerae with the usual apical tricuspid cap. Galeal setae nude. Palpi stout, with bifurcate tibial claw; seta on palpal femur with a few short branches, on genu and all 3 on tibia nude; tarsi with the usual sub-basal sensory rod, a nude subapical seta, and 4 or 5 ciliated setae. Dorsal setae short and spine-like with closely adpressed ciliations, 22 in number and arranged 2.6.6.4.2.2, somewhat variable in length in different populations from 30μ to 56μ. Ventrally with the usual pair of branched setae on maxillae, a single ciliated seta on each coxa, a pair between coxae I and between coxae III, and thereafter 2.2.4.4.2.2.2 to 25μ. Legs: I 270μ long, II 240μ, III 270μ; tarsi I and II with the usual dorsal sensory rod, III with a long sub-basal nude seta.

The Standard Data, derived from the specimens from the Philippines, Hollandia and Queensland are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	74·45±0·71	4·08±0·50	62·2–86·7	64·4–78·4	5·5
PW	85·4±0·70	3·99±0·50	73·4–97·4	75·6–92·4	4·7
SB	54·85±0·64	3·66±0·45	43·9–65·8	47·6–61·6	6·7
ASB	19·75±0·12	0·69±0·08	17·7–21·8	19·6–22·4	3·5
PSB	51·8±0·34	1·98±0·24	45·9–57·7	44·8–53·2	3·8
SD	71·55±0·32	1·85±0·23	66·0–77·1	64·4–72·8	2·6
A–P	36·45±0·47	2·68±0·33	28·4–44·5	30·8–42·0	7·3
AM	27·5±0·57	3·02±0·40	18·5–36·5	22·4–33·6	11·0
AL	24·8±0·58	3·21±0·41	15·2–34·4	22·4–33·6	13·0
PL	32·3±0·44	2·47±0·31	24·9–39·7	28·0–39·2	7·6
Sens.	49·2±0·68	2·81±0·48	40·8–57·6	44·8–53·2	5·7

This composite population shows a moderate degree of variation but there are no significant differences between that from the Philippines and those from other localities, except that the dorsal setae in the Philippine material measures to 31μ in length, whereas in the others the length is 42μ.

The Standard Data for eleven specimens of a population from a pill-millipede from Kuala Lumpur, F.M.S., are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	70·65±0·55	2·48±0·39	63·2–78·1	66·0–75·0	3·5
PW	93·9±0·67	3·01±0·48	84·9–102·9	87·0–99·0	3·2
SB	30·3±0·42	1·87±0·30	24·7–35·9	27·0–33·0	6·2
ASB	36·15±0·23	1·01±0·16	33·1–39·2	33·0–38·0	2·8
PSB	26·65±0·27	1·19±0·19	23·05–30·25	24·0–29·0	4·5
SD	62·65±0·41	1·82±0·29	57·2–68·1	60·0–67·0	2·9
A–P	33·6±0·50	2·24±0·35	26·85–40·35	27·0–36·0	6·6
AM	55·2±0·75	2·99±0·53	46·2–64·2	48·0–63·0	5·4
AL	50·4±0·50	1·85±0·32	44·85–55·95	48·0–54·0	3·6
PL	66·85±1·07	4·68±0·70	52·8–80·9	60·0–78·0	7·0
Sens.	95·8±1·27	3·12±0·90	86·4–105·2	90·0–99·0	3·2

The Standard Data of this population more closely approaches that given by Womersley and Heaslip for Walch's figures, except that AM, AL and PL are longer, as are also the dorsal setae which reach 57μ in length.

Remarks. The common occurrence of this species on a pill-millipede in Malaya is remarkable as being an exception to the assumed restricted association of the Trombiculid larvae to vertebrate hosts. A few other cases of Leeuwenhoekiids occurring on invertebrates are, however, also known.

A single specimen collected on boots at Noemfoor Is., Dutch New Guinea (D. C. Swan) has a significantly larger scutum, the Standard Data being: AW 103·6, PW 109·2, SB 64·4, ASB 35·4, PSB 58·8, SD 95·2, A–P 44·2, AM 53·2, AL 44·8, PL 58·8, Sens. —. DS to 62μ.

This specimen may be regarded as belonging to a distinct race or population.

The species was also collected in numbers on Owi Is., Biak Is., Dutch New Guinea, by Maj. G. M. Kohls, and I have seen some specimens from there, taken from boots, Aug. 7, 1944, and from *Lygosoma hinulia variegatum* Aug. 12, 1944.

TROMBICULA HIRSTI Sambon 1927.

Trombicula pseudoakamushi v. *deliensis* Walch 1923, Tr. Vth. Bien. Cong. Far East. Assoc. Trop. Med., 601, Singapore (1924).

Trombicula hirsti Sambon 1927, Ann. and Mag. Nat. Hist., (9), 20, 157; *nec.* Hirst 1929, Ann. and Mag. Nat. Hist., (10), 3, 564; Gater 1932, Parasitology, 24, 143; *nec.* Womersley 1934, Rec. S. Aust. Mus., 5, (2), 212.

Trombicula hirsti v. *morobensis* Gunther 1938 (*nom. nud.*), Med. J. Aust., 2, (6), 202.

Trombicula hirsti v. *buloloensis* Gunther 1939, Proc. Linn. Soc. N.S.W., 64, (1–2), 78.

Trombicula minor Womersley 1939, Tr. Roy. Soc. S. Aust., 63, (2), 152 (*nec.* Berlese); Gunther 1939 (Dec.), Proc. Linn. Soc. New South Wales, 64, (5–6), 466 (*nec.* Berl.); Womersley and Heaslip, Tr. Roy. Soc. S. Aust., 67 (1), 92 (*nec.* Berl.); Womersley 1944, Tr. Roy. Soc. S. Aust., 68 (1), 92.

Trombicula minor v. *deliensis* Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 94.

Trombicula *mediocris* Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 92, (nec. Berl.).

Trombicula (*Eutrombicula*) *hirsti* Sig Thor and Willmann 1947, Das Tierreich, Lfg. 71b, 285 (in part).

Plate 13, fig. E–I.

Willmann (Zool. Anz., 1940) has re-examined the types of *Trombicula minor* Berl. in the Hamburg Museum, and shown that not only were they adults from Tjompea, Java (not nymphs as assumed by other workers), but that they were labelled "aus Hohlenguano gesiebt". The latter fact was not mentioned by Berlese, but as cave guano is usually that of bats, it seems highly probable, as suggested by Ewing (Naval Med. Bull., 43, (4), 837–39, Oct., 1944), that the larvae of *T. minor* Berlese, when discovered will be found to be bat parasites.

The larvae described and recorded in recent years from Australia and New Guinea, are generally found on birds, or animals, such as bush fowl, rodents and bandicoots, etc., and it appears unlikely that they can be referred to Berlese's species. Whether, however, any of the known bat-infesting larvae are those of *T. minor* Berl. must await rearing experiments, and, in view of the urgent need for correlating the larvae with the type of *Trombicula* Berlese, every chance should be taken of rearing the known bat larvae to nymphs and/or adults; as well as of re-discovering the adults and rearing larvae therefrom.

In view of the above remarks, the question of the correct name to apply to the Australian and New Guinea species becomes important, and although still confused for the reasons stated, the synonymy appears to be as given above.

The form described by Walch in 1923 as *T. pseudoakamushi* v. *deliensis* from Sumatra, is the same as Gunther's *hirsti* v. *buloloensis* from New Guinea, but the Standard Data is slightly greater than in the typical form from Queensland as is shown in the key to species. Sig Thor and Willmann 1947 place Walch's form as a synonym of *T. pallida* Nagayo *et al.*, from which it is clearly distinct as given in the key.

As the New Guinea and Queensland material is so little different in Standard Data (see Key) the following values are given for a combination of 50 specimens from Queensland and 23 specimens from New Guinea:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	83·5±0·34	2·43±0·24	76·2–90·8	77·0–90·0	2·9
PW	96·6±0·37	2·65±0·26	88·7–104·5	90·0–104·0	2·7
SB	42·8±0·22	1·53±0·15	38·2–47·4	40·0–47·0	3·6
ASB	29·2±0·12	0·86±0·12	26·6–31·8	27·0–32·0	2·9
PSB	38·6±0·26	1·86±0·18	33·0–44·2	36·0–40·0	4·8
SD	67·8±0·29	2·09±0·21	61·6–74·0	64·0–72·0	3·1
A–P	35·9±0·17	1·23±0·12	32·2–39·6	32·0–39·0	3·4
AM	40·6±0·34	2·35±0·24	33·6–47·6	34·0–47·0	5·8
AL	45·95±0·33	2·37±0·24	38·85–53·05	40·0–50·0	5·2
PL	54·15±0·23	1·56±0·16	49·45–58·85	50·0–57·0	2·8
Sens.	64·9±0·36	1·80±0·24	59·5–70·3	60·0–68·0	2·8

HIRSTI f. NISSANENSE nov.

Trombicula hirsti Dumbleton 1947, Tr. Roy. Soc. N. Zealand, 76, 413.

Through the kindness of Dr. L. J. Dumbleton, I have been able to study a series of 14 specimens, 9 from pigs, and 5 from man, of the species which he recorded as *T. hirsti* from Nissan Is. (Green Is.), Territory of New Guinea, 1944.

In the Standard Data given below, the values are significantly higher and the population may be regarded as a distinct form:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	109·7±0·75	2·89±0·53	101·0–118·4	104·0–115·0	2·6
PW	125·7±1·16	4·48±0·82	112·3–139·1	115·0–133·0	3·6
SB	58·7±0·61	2·38±0·43	51·6–65·8	54·0–61·0	4·0
ASB	32·0	No variation recorded.			
PSB	43·0	No variation recorded.			
SD	75·0	No variation recorded.			
A–P	43·0	No variation recorded.			
AM	53·9±0·49	1·88±0·34	48·2–59·6	50·0–57·0	3·5
AL	61·2±0·82	3·17±0·58	51·7–70·7	54·0–65·0	5·1
PL	65·9±1·22	4·55±0·86	52·3–79·5	57·0–72·0	6·9
Sens.	60·6±0·64	2·23±0·46	53·9–67·3	57·0–65·0	3·7

HIRSTI f. HAKEI Radford 1946.

Trombicula hakei Radford 1946, Proc. Zool. Soc., London, 116, (2).

Radford described *T. hakei* from a Copper-headed snake (*Coluber radiatus* Schlegel) from Imphal, Manipur State, India, 10 May, 1940. I am greatly indebted to him for a paratype of his species, and from an examination of this, and of his description and figure I am convinced that it cannot be separated specifically from typical *hirsti* Sambon, except on the size of the scutum and the Standard Data, which lie between that of the typical form and f. *nissanense*.

The Standard Data from the paratype available to me, as compared with the values given by Radford (in parentheses) are: AW 95·0 (85·0), PW 110·0 (102·0), SB 43·0 (45·0), ASB 33·0 (34·0), PSB 48·0 (34·0), SD 81·0 (68·0), A–P 39·0 (34·0), AM 58·0 (45·0), AL 55·0 (40·0), PL 70·0 (54·0), Sens. 70·0 (65·0).

It is best considered as only a race or form of *hirsti* Sambon.

TROMBICULA SOBRINA sp. n.

Plate 13, fig. J–L.

Description of Larvae. Shape ovate with sides somewhat flattened. Length (engorged) to 630μ, width to 480μ. Scutum as figured, irregularly punctate, nearly twice as long as wide, anterior margin lightly sinuous; posterior margin more than twice as deep as distance between SB and PL and rather evenly curved, SB nearer to line of PL than to AL. Eyes 2 + 2, on distinct ocular shields, fairly close to lateral scutal margins and posterior the smaller. Chelicerae damaged in all specimens. Galeal setae ? Palpi stout, with bifurcate tibial claw; setae on femur with 2–3 short branches, often appearing nude; on genu nude, on tibia, dorsal and lateral nude, but ventral branched; tarsi short with sub-basal sensory rod and a subapical nude seta, and 6 ciliated setae, five of which have 3–4 short stout branches, the other being stouter with more branches and over-reaching the tip of palpal claw. Dorsal setae rather stiff and blunt with short ciliations, 20 in number and arranged 2.6.6.4.2, to 50μ long. Ventrally with a pair of branched setae on maxillae, a ciliated seta on each coxa, a pair between coxae I and between coxae III and thereafter 6.2.2.2, to 30μ long, and rather more slender than dorsal setae. Legs: I 320μ long, II 300μ, III 320μ; tarsi I and II with dorsal sensory rod, III with a long nude outstanding seta.

The Standard Data for the type and 10 paratypes are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	97·1±1·00	3·33±0·71	87·1–107·1	91·0–103·0	3·4
PW	111·3±1·09	3·61±0·77	100·5–122·1	107·0–119·0	3·2
SB	48·1±0·43	1·46±0·31	43·8–52·4	46·0–51·0	3·0
ASB	27·55±0·41	1·35±0·29	23·5–31·6	26·0–30·0	4·9
PSB	34·0±0·53	1·76±0·38	28·7–39·3	32·0–37·0	5·2
SD	61·4±0·90	2·98±0·63	52·5–70·4	58·0–66·0	4·8
A–P	34·2±0·52	1·72±0·36	29·1–39·3	32·0–37·0	5·0
AM	39·7±0·33	0·82±0·23	37·3–42·1	38·0–40·0	2·0
AL	46·1±0·64	2·02±0·45	40·1–52·1	43·0–50·0	4·4
PL	54·0±0·60	2·00±0·42	48·0–60·0	50·0–56·0	3·7
Sens.	64·0	Only one determination.			

Loc. and Host. The type and 10 paratypes from a skink, *Lygosoma stanleyanum* from the Wau-Edie Creek Rd., New Guinea, 11 Sept., 1944, along with *T. lygosomoides* sp. n. collected by the late Dr. Consett Davies.

Remarks. This species in the bifurcate palpal claw, the DS, and the punctation of the scutum, is closely allied to *T. hirsti.* It differs from that species, however, in the scutum being very much wider than long, the ratio of PW/SD = 1·86 (in *hirsti* PW/SD = 1·35 to 1·52) as in the key.

TROMBICULA ABLEPHARA sp. n.

Plate 14, fig. A–C.

Description of Larvae. Shape oval. Length (partially engorged) to 450μ, width to 360μ. Dorsal scutum as figured, with strongly sinuous anterior margin and evenly rounded posterior margin which is less than twice as deep as the distance between line of SB and PL. SB nearer to PL than to AL, surface only sparsely and irregularly punctate, sensillae missing in all specimens; scutal setae short, pointed and shortly ciliated. Eyes 2 + 2, rather small, on distinct ocular shields, posterior the smaller. Chelicerae damaged. Galeal setae nude. Palpi stout with bifurcate tibial claw; setae on femur, genu and tibia all nude; tarsi with sub-basal sensory rod, and subapical nude seta, and 5–6 ciliated setae, one of which over-reaches tip of claw. Dorsal setae stiff and only slightly curved, shortly ciliated, 22 in number, to 35μ long and arranged 2.6.6.4.2.2. Ventrally with paired branched setae on maxillae, a single ciliated seta on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 4.2.2.2, to 30μ long. Legs: I 240μ long, II 210μ, III 240μ; tarsi I and II with dorsal sensory rod, III with a long outstanding nude seta.

The Standard Data for the type and 3 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	73·25±0·75	1·50±0·53	68·75–77·75	72·0–75·0	2·0
PW	90·2±1·25	2·50±0·88	82·7–97·7	87·0–93·0	2·7
SB	36·0±0·58	1·15±0·41	32·5–39·4	35·0–37·0	3·2
ASB	21·0	No variation recorded.			
PSB	31·0±0·58	1·15±0·41	27·65–34·45	30·0–32·0	5·7
SD	52·0±0·58	1·15±0·41	48·5–55·4	51·0–53·0	2·2
A–P	29·0±0·41	0·81±0·29	26·6–31·4	28·0–30·0	2·8
AM	24·0	No variation recorded.			
AL	24·5±0·50	1·00±0·35	21·5–27·5	24·0–26·0	4·1
PL	32·5±0·50	1·00±0·35	29·5–35·5	32·0–34·0	3·1
Sens.	Missing in all specimens.				

Loc. and Host. The type and 3 paratypes from a skink *Ablepharus boutoni* from Port Moresby, New Guinea, July, 1944, collected by the late Dr. Consett Davies.

Remarks. Although the sensillae are missing in all specimens, this species is undoubtedly a true *Trombicula* in the older sense. It differs from the closely allied species as given in the key.

Another small population from a skink *Lygosoma* (*Leiolopisma*) *challengeri* from Mt. Lamington, National Park, Queensland, Dec. 1948 (H.W.) is also referred to this species, although the Standard Data are significantly greater and suggest a different race or form. The Standard Data for 7 specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	86·8±1·22	3·23±0·86	77·1–96·5	84·0–92·4	3·7
PW	104·8±1·48	3·91±1·05	93·1–116·5	98·0–109·2	3·7
SB	46·0±1·03	2·73±0·73	37·8–54·2	42·0–50·4	5·9
ASB	25·2	No variation recorded.			
PSB	28·0	No variation recorded.			
SD	53·2	No variation recorded.			
A–P	32·4±0·56	1·50±0·40	27·9–36·9	30·8–33·6	4·6
AM	30·8	No variation recorded.			
AL	33·2±0·40	1·06±0·28	30·0–36·4	30·8–33·6	3·2
PL	44·4±0·73	1·93±0·52	38·6–50·2	42·0–47·6	4·3
Sens.	60·7±0·93	1·62±0·66	55·9–65·5	58·8–61·6	2·7

TROMBICULA (TROMBICULA) WICHMANNI (Ouds. 1905).

Trombidium wichmanni Ouds. 1905. Ent. Ber., 1, (22), 217; *idem*, Nova Guinea, 1905, 5, 106, 132, pl. IV, fig. 67–68; *idem*, 1908, Tijds. Entom., 51, 25, 52, 38.

Allothrombium wichmanni Ouds. 1906. Ent. Ber. 2, (28), 58–59.

Trombidium (*Heterotrombidium*) *wichmanni*, Verdun 1909 in Cr. Soc. Biol., Paris, 67, 246.

Microtrombidium wichmanni Ouds. 1909, Ent. Ber., 3, (59), 20; *idem*, 1912, Zool. Jahrb., Suppl. 14, 9.

Trombicula mediocris Berl. 1912, Redia, 8, (1), 93; Hatori 1919, Ann. Trop. Med. Parasitol., 13, 233; Kawamura and Yamaguchi 1921, Kitasato Archiv. Exper. Med., 4, 169.

Trombicula pseudoakamushi Hatori 1920 (non Tanaka), Taiwan Igakai Zasshi, No. 209. Pt. II; *idem*, Ann. Trop. Med. Parasitol, 13, 233; Kawamura and Yamaguchi 1921, Kitasato Archiv. Exper. Med., 4, 169.

Trombicula hirsti, Gater 1932, Parasitol., 24, 147.

Trombicula wichmanni, Gunther 1940, Proc. Linn. Soc. New South Wales, 65, (5, 6), 480; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 92.

Trombicula hatorii Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 92.

Trombicula (*Eutrombicula*) *wichmanni,* Sig Thor and Willmann 1947, Das Tierreich, Lfg., 71b, 277.

Plate 14, fig. D–G.

Oudemans originally described *T. wichmanni* from the Crowned Pigeon *Goura coronata* from New Guinea, and from man in the North Celebes.

In 1940, Gunther recorded it from the mouse deer, *Tragulus borneanus* from British North Borneo. Of his material four specimens were reported on by Womesley and Heaslip in 1943 and the Standard Data therefrom given.

In 1919 Hatori referred to, but did not describe a larval *Trombicula* from Formosa under the name of "*pseudoakamushi* (*non* Tanaka)" and claimed to have reared larvae from captured adults considered to be identical with *T. mediocris* Berl. Later in 1921 Kawamura and Yamaguchi working also on Formosan material described and figured in detail the larvae of what they regarded as Hatori's species; they also obtained adults and affirmed Hatori's view that the larvae were those of *mediocris* Berl.

In 1943 Womersley and Heaslip after showing that the name *pseudoakamushi* was invalid, named the Formosan larvae as *hatorii* and gave the Standard Data based on figures and measurements of Kawamura and Yamaguchi.

The identity of the larvae with the adult *mediocris* was still regarded as not finally proven. They were, however, shown to be closely allied to *wichmanni* Ouds., only differing in the higher values of AM, AL, PL and Sens. and in the posterior scutal margin not being so sinuous medially but more evenly rounded.

I have received from Maj. R. N. McCulloch four adult *Trombicula* collected in soil in New Guinea, from which he successfully reared a number of larvae. These adults, as discussed in the Adult Section of this paper, proved upon examination to agree with the figures and data given by Kawamura and Yamaguchi for their Formosan *mediocris.* They also agreed with Berlese's description except that he gives the colour as white whereas the Formosan and New Guinea specimens were red in life. Berlese's material, however, may have become bleached in spirit.

In describing his methods of rearing larvae from adults captured in the field, Maj. McCulloch writes:

"The adult specimens later determined as *mediocris* were collected at Lae on April 9th and 10th, 1944. In searching for them and keeping them (and also

the larvae) in the laboratory I followed the advice of Maj. G. M. Kohls. In jungle where larval mites were relatively numerous, litter was scraped from the soil and adults watched for on the surface, then in the top inch of soil and finally in some patches by digging and crumbling the soil down to about 6 inches.

"In two days about 15 adult red Trombiculids were found in or close to the surface. There were also present at various depths more numerous and larger mites, probably adult Erythraeidae, etc. The adult Trombiculids were tubed individually, each with about a teaspoonful of moist soil, previously sterilized by steaming, from the locality. The test-tubes were closed by corks, perforated to allow aeration, covered with calico and inverted into the tubes to give a tight fit so that the larvae could not force their way into any space between the edge of the cork and the glass.

"The specimens were kept in the laboratory where the temperature varied between 74° F. in the early morning and 85°–88° F. in the afternoon. A few drops of water were added to the soil in each tube from time to time and a little condesed moisture was always present on the inner wall of the tube. In this manner, larvae of *Schöngastia blestowei* were kept alive for as long as 46 days.

"The living adult Trombiculids were examined from time to time as other work allowed. On May 15th it was observed that one adult had produced more than a dozen larvae apparently sometime earlier. No eggs were found. Some of the other adults had died, and the remainder had then to be killed. The specimens of larvae and adults were then forwarded to Adelaide for identification."

This species is certainly very closely related to *hirsti* Sambon as was shown by Sambon 1927. The difference of the evenly curved posterior scutal margin in *hirsti* (sic *minor*) and the medially sinuous margin in *wichmanni*, given by Womersley and Heaslip in 1943 is not easy to use in practice. The two species differ more markedly, however, in the greater depth of the posterior scutal margin in *hirsti*, than in *wichmanni*. In *hirsti*, the greatest depth of the posterior margin beyond the line of PL is twice or more, than the distance between the lines of SB and PL; in *wichmanni* it is less than twice the distance.

The relationship of *T.* (*T.*) *wichmanni* (Ouds.) to other species is shown in the new key to the species. Along with *T.* (*T.*) *ablephara* sp. n. it differs from *T.* (*T.*) *hirsti* Sambon and *T.* (*T.*) *sobrina* sp. n. in the much shallower posterior scutal margin. From *ablephara* it differs in having both the femoral and ventro-tibial setae of the palpi branched. The surface of the dorsal scutum is distinctly striate-punctate as is clearly indicated in Oudemans' figures, and in this feature *wichmanni* is closely related to the *scincoides-kohlsi-tovelli* group, but differs in the presence of a long nude seta on tarsi III.

As in other species of which a fair amount of material from different localities is available for study, the different populations show significant variations in the Standard Data measurements.

Four of these populations have been examined biometrically, as given in Table B. The populations are:

I. Borneo: Six specimens from C. Gunther from the mouse deer, *Tragulus borneanus*, from Bode River, 1939; eleven specimens collected by R. N. McCulloch as follows: Labuan, 17 June, 1945, on boots (1); Limbang, 22 July, 1945, on boots (3); Balikpapan, 23 Aug., 1945 (1); ditto, 1 Sept., 1945, on rotten log (1); Brunei, 8 July, 1945, on boots (1), 20 July, 1945, on boots (3); (seventeen specimens in all).

II. Celebes: Morotai, Halmahera, on boots in Sabala scrub, 13 and 14 May, 1945, (3 spec.), (R.N.McC.).

III. New Guinea: Lae 11 Mar., 1944 (1), 17 Apr., 1944 (1) on boots (R.N.McC.); Dobodura, 6 Sept., 1943 (1 on man), (R.N.McC.); Dobodura, June, 1944, on snake (5), (G. M. Kohls); Lae, 10 Apr., 1944, (1 spec. reared from adult identified as *T. mediocris* Berl.), (R.N.McC.), nine specimens in all).

IV. Philippine Island: Bagabag, Luzon, 10 Aug., 1945, (6 spec. off Man), (C. B. Philip and A. Mundan).

From the Analysis of Variance of these populations (Table B) it is seen that the variation between the populations is significantly different from the variation within the populations at the 0·1% level of probability.

Similarly the Difference of Means of the Standard Data of the population from Borneo compared with those of other populations in general, also shows significant variations as in the following table.

TABLE A.

Significance of Differences of Standard Data of 3 Populations of T. (T.) wichmanni *compared with a fourth populations from Borneo, at* 5%, 1% *and* 0·1% *probability.*

	AW	PW	SB	ASB	PSB	SD	A–P	AM	AL	PL	Sens.
Celebes	+++	+++	+++	—	++	+	—	++	+++	+++	—
New Guinea	—	—	+	+++	—	+++	+++	+	++	+++	+++
Philippines	—	+++	+++	—	+++	++	++	+	+++	++	+

— Not significant ++ Significant at 1 p.c.
+ Significant at 5 p.c. +++ Significant at 0·1 p.c.

As the values of F in the Analysis of Variance in the above populations, although significant at the 0·1% level of probability given in Fisher's Tables, are very much lower than those found in the different populations of *T. deliensis* and *akamushi*, it would seem uncertain whether the populations of *wichmanni* are sufficiently distinct to justify racial trinomial names. For the present it seems advisable to do no more than indicate that in the Standard Data, there are biometric differenecs between the populations from different areas.

TABLE B.

Frequency of different values of Standard Data in microns for four populations of *Trombicula wichmanni* (Ouds.).

N.B.—The variance Ratio (F) from Fisher's tables for n/n_2 at the 0·1% level is given in parenthesis.

AW = Anterior width of dorsal scutum as measured between AL.

AW	I	II	III	IV	Total
83	1/83		1/83		166
84					
85			2/170		170
86	4/344		2/172		516
87					
88	3/264				264
89	2/179		1/89		267
90	5/450			4/360	810
91			2/182	1/91	273
92					
93			1/93	1/93	186
94	2/188				188
95					
96					
97		2/194			194
98					
99					
100					
101		1/101			101
	17/1507	3/295	9/789	6/544	3,135
$M \pm \sigma_M$	88·65±0·68	98·3±1·34	87·55±1·14		90·7±0·49
$S \pm \sigma_S$	2·81±0·48	2·32±0·95	3·43±0·81		1·21±0·35

Analysis of Variance.

Variability.	f.	Mean Sq.	F.
Between Groups	3	95·2889	12·37 (7·05)
Within Groups	31	7·7001	

PW = Posterior width of scutum as measured between PL.

PW	I	II	III	IV	Total
95			1/95		95
96					
97			2/194		194
98					
99					
100	1/100				100
101	4/404		2/202		606
102					
103					
104	9/936		3/312	1/104	1,352
105					
106	1/106				106
107					
108	2/216		1/108	1/108	432
109					
110				2/220	220
111		1/111		2/222	333
112					
113					
114					
115		2/230			230
	17/1,762	3/341	9/911	6/654	3,668
$M \pm \sigma_M$	103·65±0·56	113·7±1·34	101·2±1·41		109·0±1·09
$S \pm \sigma_S$	2·31±0·40	2·32±0·95	4·24±1·0		2·68±0·77

Analysis of Variance.

Variability.	f.	Mean Sq.	F.
Between Groups	3	159·8318	17·94 (7·05)
Within Groups	31	8·9066	

SB = as measured between sensillae bases.

SB	I	II	III	IV	Total
40	1/40				40
41					
42	1/42		1/42		84
43	11/473		1/43		516
44					
45	2/90		4/180	1/45	315
46					
47	2/94	1/47	2/94	5/235	470
48			1/48		48
49					
50		2/100			100
	17/739	3/147	9/407	6/280	1,573
$M \pm \sigma_M$	43·35±0·41	49·0±1·0	45·2±0·64		46·7±0·33
$S \pm \sigma_S$	1·70±0·29	1·73±0·71	1·92±0·45		0·82±0·23

Analysis of Variance.

Variability.	f.	Mean Sq.	F.
Between Groups	3	34·9205	12·7 (7·05)
Within Groups	31	2·7459	

ASB = distance between anterior margin of dorsal scutum and a line joining centres of sensillae bases.

ASB	I	II	III	IV	Total
26			4/104		104
27	1/27		1/27		54
28					
29	5/145		3/87		232
30					
31					
32	11/352	3/96	1/32	6/192	672
	17/542	3/96	9/250	6/192	1,062
$M \pm \sigma_M$	30·8=0·41	32·0	27·8±0·70		32·0
$S \pm \sigma_S$	1·70±0·29	—	2·11±0·50		—

Analysis of Variance.

Variability.	f.	Mean Sq.	F.
Between Groups	3	29·8595	11·28 (7·05)
Within Groups	31	2·646	

PSB = distance between posterior margin of dorsal scutum and a line joining sensillae bases.

PSB	I	II	III	IV	Total
30	2/60		2/60		120
31					
32	10/320		6/192		512
33					
34	2/68				68
35					
36	3/108	3/108	1/36	6/216	468
	17/556	3/108	9/288	6/216	1,168
$M \pm \sigma_M$	32·7±0·45	36·0	32·0±0·99		36·0
$S \pm \sigma_S$	1·86±0·32	—	2·19±0·73		—

Analysis of Variance.

Variability.	f.	Mean Sq.	F.
Between Groups	3	28·8807	11·26 (7·05)
Within Groups	31	2·5655	

SD = total depth of dorsal scutum = ASB + PSB.

SD	I	II	III	IV	Total
56			1/56		56
57	1/57				57
58			3/174		174
59	1/59		2/118		177
60					
61	4/244		2/122		366
62					
63					
64	6/384				384
65					
66	2/132				132
67					
68	3/204	3/204		6/408	816
	17/1,080	3/204	8/470	6/408	2,162
$M \pm \sigma_M$	63·5±0·77	68·0	58·75±0·51		68·0
$S \pm \sigma_S$	3·18±0·55	—	1·67±0·42		—

Analysis of Variance.

Variability.	f.	Mean Sq.	F.
Between Groups	3	120·8333	19·94 (7·05)
Within Groups	30	6·0575	

A–P = distance between AL and PL.

A–P	I	II	III	IV	Total
32	1/32		8/256		288
33	1/33		1/33		66
34					
35	4/140				140
36	6/216			2/72	288
37		1/37			37
38					
39	5/195	2/78		4/156	429
	17/616	3/115	9/289	6/228	1,248
$M \pm \sigma_M$	36·2±0·52	38·3±0·67	32·1±0·11		38·0±0·63
$S \pm \sigma_S$	2·14±0·37	1·16±0·47	0·33±0·08		1·55±0·45

Analysis of Variance.

Variability.	f.	Mean Sq.	F.
Between Groups	3	57·7571	20·42 (7·05)
Within Groups	31	2·8585	

AM = length of antero-median scutal seta.

AM	I	II	III	IV	Total
39			1/39		39
40	1/40	1/40	2/80		160
41			1/41		41
42	1/42				42
43	2/86	2/86	2/86		258
44					
45	2/90				90
46					
47	4/188				188
48	1/48		1/48		96
49					
50	4/200			3/150	350
51					
52					
53					
54					
				1/54	54
	15/694	3/126	7/294	4/204	1,318
$M \pm \sigma_M$	46·3±0·82	42·0±1·0	42·0±1·15		51·0±1·0
$S \pm \sigma_S$	3·19±0·58	1·73±0·71	3·05±0·82		2·0±0·71

Analysis of Variance.

Variability.	f.	Mean Sq.	F.
Between Groups	3	84·0797	9·69 (7·45)
Within Groups	25	8·6773	

AL = length of antero-lateral scutal setae.

AL	I	II	III	IV	Total
43			1/43		43
44					
45			2/90		90
46					
47		3/141			141
48	1/48		2/96		144
49					
50	5/250		1/50		300

AL	I	II	III	IV	Total
51	1/51				51
52	1/52		1/52		104
53					
54	9/486		1/54	1/54	594
55					
56				1/56	56
57				3/171	171
58					
59					
60					
61				1/61	61
	17/887	3/141	8/385	6/342	1,755
$M \pm \sigma_M$	52·2±0·52	47·0	48·1±1·32		57·0±0·93
$S \pm \sigma_S$	2·13±0·36	—	3·74±0·94		2·28±0·66

Analysis of Variance.

Variability.	f.	Mean Sq.	F.
Between Groups	3	112·7279	16·92 (7·05)
Within Groups	30	6·6615	

PL = length of postero-lateral scutal setae.

PL	I	II	III	IV	Total
50			2/100		100
51					
52					
53			1/53		53
54		2/108			108
55			2/110		110
56			2/112		112
57	1/57	1/57			114
58	1/58				58
59					
60	2/120				120
61	7/427		1/61	1/61	549
62	1/62				62
63	2/126			1/63	189
64	2/128				128
65	1/65			1/65	130
66					
67					
68				3/204	204
	17/1,043	3/165	8/436	6/393	2,037
$M \pm \sigma_M$	61·35±0·5	55·0±1·0	54·5±1·23		65·5±1·23
$S \pm \sigma_S$	2·06±0·35	1·73±0·71	3·58±0·90		3·01±0·87

Analysis of Variance.

Variability.	f.	Mean Sq.	F.
Between Groups	3	176·451	25·28 (7·05)
Within Groups	30	6·9794	

Sens. = length of sensillae.

Sens.	I	II	III	IV	Total
60			1/60		60
61					
62					
63					
64			3/192		192
65		1/65		1/65	130
66			1/66		66
67					
68	4/272			2/136	408
69					
70	2/140	1/70			210
71					
72	5/360				360
73					
74					
75	1/75				75
	12/847	2/135	5/318	3/201	1,501
$M \pm \sigma_M$	70·6±0·66	67·5±2·5	63·6±0·99	67·0±1·0	
$S \pm \sigma_S$	2·27±0·46	3·53±1·77	2·20±0·69	1·73±0·70	

Analysis of Variance.

Variability.	f.	Mean Sq.	F.
Between Groups	3	59·749	11·367 (8·49)
Within Groups	18	5·2564	

A further population of nineteen specimens collected from a species of *Lygosoma* at Kerowie, N.G. at 5,000 feet by the late Dr. Consett Davis has the following Standard Data. It comes very close to the small population from the Celebes reported above, in that it does not differ significantly at the 0·1% level of probability.

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	98·2±0·53	2·32±0·38	91·3–105·1	94·0–101·0	2·4
PW	113·25±0·44	1·94±0·31	107·45–119·05	110·0–117·0	1·7
SB	48·85±0·39	1·71±0·28	43·7–54·0	45·0–52·0	3·5
ASB	27·3±0·35	1·53±0·25	22·7–31·9	25·0–29·0	5·6
PSB	32·4±0·15	0·84±0·12	29·9–34·9	32·0–34·0	2·6
SD	59·85±0·44	1·92±0·31	54·1–65·6	57·0–63·0	3·2
A–P	36·25±0·45	1·97±0·32	30·35–42·15	32·0–39·0	5·4
AM	35·95±0·46	2·03±0·33	29·3–42·0	32·0–39·0	5·6
AL	45·0±0·46	2·00±0·32	39·0–51·0	43·0–47·0	4·4
PL	53·1±0·60	2·62±0·42	45·3–60·9	47·0–57·0	4·9
Sens.	67·0±0·80	3·40±0·57	56·8–77·2	61·0–72·0	5·0

From Malaya (Kuala Lumpur district) also I have been able to study a large number of specimens of *wichmanni*, and from this population of 47 specimens, including 17 of Gater's original Malayan material labelled as "*Trombicula hirsti* Sambon", the Standard Data is as follows: The slides of Gater's and the other material were kindly sent to me by Dr. J. R. Audy.

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	88·5±0·40	2·74±0·28	80·3–96·7	84·0–95·2	3·1
PW	107·75±0·50	3·46±0·36	97·4–118·1	103·6–114·8	3·2
SB	45·3±0·17	1·20±0·12	41·7–48·9	44·8–50·4	2·6
ASB	31·75±0·21	1·43±0·15	27·45–36·05	28·0–33·6	4·5
PSB	34·55±0·26	1·78±0·18	29·2–39·9	30·8–36·4	5·2
SD	66·3±0·41	2·83±0·29	57·8–74·8	61·6–70·0	4·3
A–P	36·4	No variation recorded.			
AM	49·1±0·36	2·20±0·25	42·5–55·7	42·0–50·4	4·4
AL	53·8±0·44	2·80±0·31	45·4–62·3	47·6–58·8	5·2
PL	60·2±0·39	2·48±0·27	52·8–67·6	53·2–64·4	4·1
Sens.	61·7±0·28	1·33±0·20	57·7–65·7	58·8–64·4	2·1

TROMBICULA ANOUS (Wharton 1945).

Acariscus anous Wharton 1945, J. Parasitol., 31, (6), 403.

Plate 14, fig. H–J.

This species was recently described by Dr. G. W. Wharton for specimens found on the wings of the Tattler, *Anous stolidus* and Noddy, *Heteroscelus incanus* from Ypao Point, Guam, 27 May, 1925. I am gratefully indebted to him for the presentation of two paratypes from which the following details and the figures are taken.

The body shape is ovoid. The length of engorged specimens to 390μ, and the width to 300μ. The scutum is sparsely and finely punctate, and as figured, with the anterior margin strongly sinuate and posterior margin moderately deep

behind line of PL; sensillae bases distinctly in advance of PL. Eyes 2 + 2, on distinct ocular shields, posterior the smaller. Chelicerae with only the usual apical tricuspid cap. Galeal setae nude. Palpi stout, tibial claw rather strongly curved and bifurcate; seta on palpal femur with 5–6 branches, fine; on genu with 2–3 short branches; all setae on tibia apparently nude. Dorsal setae long and slender, with fine ciliations, to 70μ long, and arranged ca. 2.8.8.6.4.4.2 = 34 in number. Ventrally with the usual pair of branched setae on gnathosoma, a single seta on each coxa, a pair between coxae I and between coxae III and thereafter approximately 8.8.8.6.4.4.2. to 40μ long. Tarsi of leg III with a long nude seta. The Standard Data are: AW 103·0, PW 118·0, SB 44·0, ASB 36·0, PSB 23·0, SD 59·0, A–P 32·0, AM 43·0, AL 60·0, PL 85·0, Sens. 90·0.

TROMBICULA PLUVIUS (Wharton 1945).

Acariscus pluvius Wharton 1945, J. Parasitol., 31, (6), 401.

Plate 14, fig. K–M.

Dr. G. W. Wharton has very kindly furnished me with two paratypes from the Noddy, *Anous tenuirostris,* from the Jaba River, Bougainville, 9 Jan., 1945, from which the following details and the figures are drawn.

Shape of body ovoid. Length (engorged) 450μ, width 360μ. Dorsal scutum sparsely and finely punctate, but smaller than in *anous* and with the posterior scutal margin very shallow behind line of PL; sensillae bases slightly anterior of PL. Eyes 2 + 2, on distinct ocular shields and posterior the smaller. Chelicerae simple, with only the apical tricuspid cap. Galeal setae nude. Palpi stout, with bifurcate, strongly curved tibial claw; seta on palpal femur with short branches; all setae on genu and tibia apparently nude. Dorsal setae long, finely ciliated, to 70μ long, and arranged approximately 2.10.8.8.4.4.2 = 38 in number. Ventrally with the usual pair of branched setae on gnathosoma, one on each coxa, a pair between coxae I and between coxae III and thereafter approximately 10.8.8.8.6.4.2 = 46. Tarsi of leg III with a long nude outstanding seta. The Standard Data are: AW 86·0, PW 90·0, SB 36·0, ASB 29·0, PSB 16·0, SD 45·0, A–P 30·0, AM 50·0, AL 40·0, PL 72·0, Sens. 60·0.

Loc. Cape Torokina, Empress Augusta Bay, Bougainville Island, Australian Mandate; Ypao Point, Guam, Mariana Islands.

Hosts. Pluvialis dominica, Anous tenuirostris, Anous stolidus, Heteroscelus incanus.

Remarks. This and the preceding species are very close together in the curved bifurcate palpal claw and the general form of the scutum, but differ in the size of the scutum and in the number and arrangement of DS.

TROMBICULA LYGOSOMOIDES sp. n.

Plate 15, fig. A–D.

Description of Larvae. Shape oval. Length unfed, 345μ; width 240μ. Dorsal scutum lightly and irregularly punctate, much wider than long, anterior margin slightly concave, posterior margin flattened medially and laterally rather angular (see Pl. 15, fig. A); sensillae bases only slightly in advance of line of PL. Eyes 2 + 2, on distinct ocular shields, posterior eyes the smaller. Chelicerae with only the usual tricuspid cap. Galeal setae nude. Palpi stout, tibial claw bifurcate, setae on palpal femur, genu and tibia all nude; tarsi with basal and subapical sensory rods, and 5 or 6 ciliated setae, one of which is longer and stronger than the others and over-reaches the tip of the tibial claw. Dorsal setae 26(28) in number, arranged 2.6(8).6.6.4.2, to 55μ long. Ventrally with the usual pair of branched setae on gnathosoma, a ciliated seta on each coxa, a pair between coxae I and between coxae III, and thereafter 4.2.2.2, to 25μ long. Legs: I 300μ long, II 280μ, III 300μ; tarsi I and II with the usual dorsal rod-like seta, and tarsi III with a long outstanding nude seta.

The Standard Data, in microns derived from seven specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	102·7±0·86	2·29±0·61	95·85–109·55	100·0–106·0	2·25
PW	123·0±0·64	1·68±0·45	118·0–128·0	120·0–124·0	1·4
SB	47·6±0·61	1·62±0·43	42·8–52·4	45·0–50·0	3·4
ASB	29·0	No variation recorded.			
PSB	37·1±0·67	1·77±0·47	31·8–42·4	35·0–40·0	4·8
SD	65·9±0·67	1·77±0·47	60·6–71·2	64·0–69·0	2·7
A–P	33·9±0·55	1·46±0·31	29·5–38·3	32·0–35·0	4·3
AM	38·3±0·84	2·07±0·59	32·1–44·5	35·0–40·0	5·4
AL	47·7±0·80	1·97±0·57	41·8–53·6	46·0–50·0	3·1
PL	53·1±1·18	3·11±0·83	43·8–62·4	50·0–56·0	5·8
Sens.	64·0	Only one determination.			

Loc. Seven specimens from the lizard *Lygosoma stanleyanum*, from the Wau-Edie Creek Rd., T.N.G., 11 Sept., 1944, collected by the late Dr. Consett Davis.

Remarks. In the bifurcate tibial claw this species is a *Eutrombicula* in Ewing's original definition, but in the number of dorsal setae it comes into *Acariscus* as separated later by the same author, both of which genera are now considered synonymous with *Trombicula.*

It may be separated from its allies as in the key to species and on the form of the dorsal scutum.

TROMBICULA (TROMBICULA) SAMBONI Wom. 1939.

Trombicula samboni Womersley 1939, Tr. Roy. Soc. S. Aust., 63 (2), 153; *ibid*, 1943, 67, (1), 95.

Trombicula hirsti Hirst 1929, Ann. Mag. Nat. Hist., (10), 3, 564; *nec* Sambon 1927; Womersley 1934, Rec. S. Aust. Mus., 5, (2), 212, *nec* Sambon 1927.

Plate 15, fig. E–H.

This species is distinguished from *T. hirsti* Sambon 1927 in the number of DS. *T. samboni* is a common species in the south-east of South Australia, while *hirsti* is a Queensland and New Guinea species.

In the new key to species it comes close to *lygosomoides* sp. n. but is easily distinguished by the shape of the dorsal scutum, and the setae on the palpal femur and genu, and ventrally on the tibia, being branched.

From the following species, *T.* (*N.*) *sarcina* (Wom. 1944), which is also a Queensland species, it differs in having only 26, instead of 28 DS, and more particularly in that in *sarcina* the posterior 12 DS are not in regular transverse rows, but arranged in two lateral clusters of 6 each, which have the counterpart on the ventral surface.

The following Standard Data in microns is derived from 20 specimens:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	87·8±0·87	3·90±0·61	76·1–99·5	83·0–96·0	4·4
PW	97·7±0·83	4·18±0·66	85·2–110·2	93·0–108·0	4·2
SB	39·7±0·50	2·24±0·35	33·0–46·4	37·0–45·0	5·6
ASB	39·05±0·44	1·96±0·31	33·15–44·95	35·0–42·0	5·0
PSB	29·2±0·32	1·44±0·23	24·9–33·5	27·0–33·0	4·9
SD	68·2±0·63	2·81±0·44	59·8–76·6	62·0–74·0	4·1
A–P	31·6±0·30	1·36±0·21	27·5–35·7	29·0–33·0	4·3
AM	40·3±0·32	1·18±0·22	36·8–43·8	38·0–43·0	2·9
AL	45·2±0·48	2·06±0·34	39·0–51·4	43·0–50·0	4·5
PL	52·1±0·43	1·92±0·30	46·3–57·9	50·0–56·0	3·7
Sens.	72·2±0·95	3·29±0·67	62·3–82·1	68·0–80·0	4·6

TROMBICULA (NEOTROMBICULA) SARCINA (Wom. 1944).

Trombicula sarcina Womersley 1944, Tr. Roy. Soc. S. Aust., 68, (1), 95; Gill, Moule and Riek, 1945, Aust. Vet. J., 32, fig.

Plate 15, fig. I–L.

This is a very striking species, in that the posterior dorsal and ventral setae are arranged into two lateral clusters. It is an important economic species, for although its natural host is the Grey Kangaroo *Macropus giganteus* (Zimmer-

mann), in the Clermont district of Queensland it has been found to cause a serious "Trombidiosis" of sheep. (See Gill *et al.*, A. Vet. J., 1945, p. 22).

In the revised key to species it comes next to *T.* (*T.*) *samboni* Wom. from South Australia, but it is at once distinguished by the postero-lateral clusters of dorsal setae. It is also related to *T.* (*?T.*) *macropus* (Wom. 1936) and *T.* (*?T.*) *rioi* (Gunther 1939) but apart from other minor differences the posterior dorsal setae in these are not in two clusters, and the total dorsal setae are more in these two species.

The following Standard Data are derived from 9 specimens of the original material:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	83·3±0·72	2·18±0·51	76·8–89·8	80·0–86·0	2·6
PW	92·4±1·16	3·47±0·82	82·0–102·2	86·0–96·0	3·7
SB	40·0±0·41	1·22±0·29	36·3–43·7	38·0–41·0	3·0
ASB	27·0	No variation recorded.			
PSB	34·9±0·36	1·09±0·26	31·6–38·3	32·0–37·0	3·1
SD	62·0±0·43	1·32±0·31	58·0–66·0	59·0–64·0	2·1
A–P	33·5±0·38	1·13±0·27	30·1–36·9	32·0–35·0	3·4
AM	31·5±0·71	2·13±0·50	25·1–37·9	29·0–33·0	6·8
AL	40·1±0·48	1·45±0·34	35·7–44·5	38·0–42·0	3·6
PL	46·1±0·82	2·47±0·58	38·7–53·5	43·0–50·0	5·3
Sens.	64·3±1·66	4·08±1·18	52·1–76·5	60·0–70·0	6·8

TROMBICULA KANZALWANENSIS sp. n.

Plate 21, fig. H–L.

Description of Larvae. Shape ovoid. Length (unengorged) 260μ, width 182μ. Scutum finely punctate, shaped as figured with deep, evenly rounded posterior margin; SB slightly behind line of PL. Eyes 2 + 2, on ocular shields, posterior the smaller. Palpi with bifurcate tibial claw; setae on femur and genu strongly branched, on tibia only the ventral branched. Chelicerae simple, with only the apical tricuspid cap. Galeal setae nude. Dorsal setae strongly ciliated, ca. 52 in number, arranged 3 humeral on each side to 53μ long, then 10.2(lateral).8.2.10.8.4.2, to 42μ long. Ventrally with a pair of branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 12.8.6.6.6.4, to 45μ long. Coxae finely punctate. Legs: 1 270μ long, II 240μ, III 280μ; coxae I and II with dorsal sensory rod; tarsi III with a long nude outstanding seta; telofemur of leg I with a pair of very long straight outstanding ciliated setae; telofemur of legs II and III with one such seta.

The Standard Data for the type and one paratype are:

	AW	PW	SB	ASB	PSB	SD	A–P	AM	AL	PL	Sens.
Type	70·0	89·6	30·8	28·0	28·0	56·0	25·2	42·0	42·0	56·0	70·0
Paratype	75·6	95·2	33·6	28·0	28·0	56·0	25·2	42·0	42·0	56·0	70·0

Loc. and Host. The type and one paratype from rats, Kanzalwan, India, Oct. 10–11th, 1946 (S. L. Kalra).

Remarks. A characteristic species on the humeral setae, and the long stiff outstanding ciliated setae on telofemora of legs.

TROMBICULA MACROPUS Wom. 1936.

Trombicula macropus Womersley 1936, J. Linn. Soc., London (Zool.), 40, (269), 112; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 97; Sig Thor and Willmann 1947. Das Tierreich, Lfg., 71b, 272.

Plate 16, fig. A–D.

As stated above, this species is closely related to *T.* (*N.*) *sarcina* (Wom.) and to *T.* (*?T.*) *rioi* (Gunther), differing from both in the number of dorsal setae as given in the key, and from the former in that the posterior dorsal setae are not in two groups. It was originally described from specimens found in the groin of a wallaby, *Macropus* sp., from Darwin, Northern Territory of Australia. No fresh material has come to hand and the following Standard Data is given from 5 specimens of the original material:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	83·4±1·03	2·30±0·73	76·5–90·3	80·0–85·0	2·7
PW	89·8±0·73	1·64±0·52	84·9–94·7	88·0–91·0	1·8
SB	36·0±0·63	1·41±0·45	31·8–40·2	34·0–37·0	3·9
ASB	27·0±0·63	1·41±0·45	22·8–31·2	25·0–29·0	5·2
PSB	34·2±0·49	1·09±0·35	30·9–27·5	33·0–35·0	3·2
SD	61·2±0·89	1·99±0·63	55·3–67·1	60·0–64·0	3·2
A–P	31·6±0·40	0·89±0·28	28·9–34·3	30·0–32·0	2·8
AM	35·7±0·77	1·15±0·54	32·2–39·2	35·0–37·0	3·2
AL	40·0	No variation recorded.			
PL	54·0±1·09	2·50±0·77	46·7–61·3	50·0–56·0	4·5
Sens.	72·0	No variation recorded.			

TROMBICULA RIOI Gunther 1939.

Trombicula rioi Gunther 1939, Proc. Linn. Soc. N.S.W., 64, (1–2), 80; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 91.

Plate 16, fig. E–H.

Although closely related to the preceding species, in that the posterior dorsal setae are somewhat clustered together, this species differs in the total number of dorsal setae and the size of the dorsal scutum.

The palpi are stout, and the bifurcate tibial claw rather short. The seta on the palpal femur is strongly branched, on the genu and the dorsal and lateral on the tibia are nude, the ventral tibial seta is branched. The chelicerae has only the apical tricuspid cap and the galeal setae are nude and strong. The posterior dorsal setae are stronger and more strongly ciliated than the anterior ones. Tarsi III has a long nude outstanding seta.

In addition to the type and 3 paratypes reported on by Womersley and Heaslip 1943, an additonal 9 specimens collected from the mound of a bush turkey at Dobodura, N.G., 13 July, 1944, by Maj. G. M. Kohls have now been seen.

The Standard Data in microns derived from these 9 specimens and two paratypes are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	104·4±0·93	3·09±0·66	95·1–113·7	100·8–112·0	2·9
PW	117·1±1·26	4·17±0·89	104·6–129·6	112·0–123·2	3·6
SB	55·75±0·59	1·96±0·42	49·9–61·6	53·2–58·8	3·5
ASB	33·85±0·25	0·84±0·18	31·3–36·4	33·6–36·4	2·5
PSB	34·1±0·34	1·13±0·24	30·7–37·5	33·6–36·4	3·3
SD	68·0±0·39	1·31±0·28	64·1–71·9	67·2–70·0	1·9
A–P	33·6±0·38	1·25±0·27	29·8–37·4	30·8–36·4	3·7
AM	60·7±1·16	3·49±0·82	50·2–71·2	56·0–64·4	5·7
AL	65·25±1·51	4·76±1·07	50·95–79·75	61·6–72·8	7·3
PL	67·5±1·48	4·92±1·05	52·7–82·3	61·6–75·6	7·3
Sens.	68·4±1·03	2·73±0·73	60·2–76·6	64·4–70·0	4·0

TROMBICULA COLUBERINA (Radford 1946).

Fonsecia coluberina Radford 1946, Proc. Zool. Soc. London, 116, (2), 249.

Plate 16, fig. I–L.

In 1942 (Parasitology, 34, 55–81) Radford erected the genus *Fonsecia* for the two South American species *Trombicula travassosi* Fonseca 1935 and *T. ewingi* Fonseca 1932, citing *Ewingi* as the type. The generic separation was based only on the fact that in both these species the AL setae and in *travassosi* also the AM seta, are short and stumpy and nude.

In the writer's opinion these features are insufficient to separate these species generically from *Trombicula* s.l., and until the adults and nymphs are known even subgeneric separation seems undesirable.

In 1946, Radford described and ascribed to his genus a third species, *coluberina* from a Copper-headed rat snake (*Coluber radiatus* Schlegel) from Imphal, Manipur State, India, and also recorded the same species from a cobra (*Naia tripudians fasciatus* Gray) from Imphal.

As in *ewingi* the AM and PL scutal setae are long and filamentous, but are stated to be "unfeathered." The dorsal scutum is longer than wide, with the posterior margin evenly rounded. The eyes are 2 + 2, but very small. No details of the palpi are given. The dorsal setae, similar to the scutal setae, are nude; they number 32, to 30μ long and are arranged 2.6.8.6.6.4. The ventral setae are also simple, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 50, posteriorly the longest. Apparently no long nude seta on tarsi III.

The Standard Data as given by Radford are: AW 68·0, PW 83·0, SB 26·0, ASB 31·0, PSB 29·0, SD 60·0, A–P 26·0, AM 51·0, AL 20·0, PL 51·0, Sens. 68·0.

A paratype kindly given to me by Dr. Radford has the following Standard Data: AW 67·2, PW 81·2, SB 28·0, ASB 25·2, PSB 30·8, SD 62·0, A–P 25·2, AM 53·2, AL 16·8, PL 47·6, Sens. —. From this specimen it can be seen that the scutal and dorsal, as well as the ventral setae, are not quite nude but are furnished with short sparse and indistinct barbs. The paired setae on the maxillae are shortly but distinctly branched. The chelicerae are non-serrate and the galeal setae fine, short and nude. The palpal claws are bifurcate; the seta on palpal femur finely and indistinctly barbed, the setae on palpal genu and tibia all nude. The dorsal and ventral setae are arranged as in the type description.

All legs 7-segmented; I 300μ long, II 270μ, III 300μ; tarsi I and II with usual dorsal rod, III without any long outstanding nude seta. The specimen, only partially engorged, is 365μ long and 260μ wide.

TROMBICULA BATUI Philip and Traub 1950.

J. Parasitol., 1950, 36, (1), 29–32, fig. 1.

Plate 17, fig. A–C.

This very interesting species was described by Philip and Traub from a number of specimens from bats *Eonycteria spelaea* in the Batu Caves, near Kuala Lumpur, Federated Malay States.

The dorsal scutum is very small, not much wider between PL than it is long and is coarsely punctate; the posterior margin forms a shallow angle; AM is slightly in front of AL, and the sensillae bases are slightly nearer to PL than to AL and anteriorly with strongly defined crests; the sensillae are very characteristic, being nude, but with a single fork at midlength. Chelicerae simple. Galeal setae nude. Palpal claw bifurcate; seta on femur with 3 or 4 short branches, on genu 1-branched, on tibia all nude. Dorsal setae short, to 26μ, ca. 36 in number and arranged 2.8.8.6.6.4.2, with short ciliations or branches. Ventrally, a pair of branched setae on maxillae, a ciliated seta on each coxa, a pair between coxae I and between coxae III and thereafter ca. 40, the posterior setae nearly as long as the dorsal. No long nude seta on tarsi III.

The Standard Data treated statistically from those given by the authors for the type and 4 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	39·8±1·83	4·08±1·29	27·6–52·0	36·0–45·0	10·2
PW	48·2±1·9	4·25±1·34	35·5–60·9	45·0–54·0	8·8
SB	18·6±0·98	2·19±0·69	12·0–25·2	16·0–21·0	11·8
ASB		Not given.			
PSB	19·6±0·81	1·82±0·54	14·2–25·0	18·0–22·0	9·3
SD		Not given.			
A–P	24·7±0·73	1·64±0·52	19·8–29·6	23·0–26·5	6·6
AM	27·4±0·40	0·89±0·28	24·7–30·1	26·0–28·0	3·2
AL	23·2±0·73	1·64±0·52	18·3–28·1	22·0–26·0	7·1
PL	30·0±1·64	3·67±1·16	15·9–44·1	27·0–34·0	12·2
Sens.	39·6±1·21	2·70±0·85	31·5–47·7	37·0–44·0	6·8

The possibility of this species being the true larvae of *Trombicula minor* Berl., when the larvae and adult have been correlated, is discussed by the authors.

TROMBICULA (? NEOTROMBICULA) MUNDA (Gater 1932).

Trombicula munda Gater 1932, Parasitol., 24, 143–174; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 76.

Trombicula (*Eutrombicula*) *munda,* Sig Thor and Willmann 1947, Das Tierreich, Lfg. 71b, 289.

Plate 17, fig. D–F.

This species was originally described from specimens from *Rattus rattus diardi* (Jentink) from Kuala Lumpur, Federated Malay States. Gater also recorded it from *R. mulleri validus* (Miller) and *R. malaisa* Kloss, from Sungei Buloh, F.M.S.

It is very close to the following species, but differs in the Standard Data and the sensillae as given in the key to species. The sensillae in *munda* have only 2 or 3 distal branches, whereas in *spicea* they have numerous ciliations distally, appearing almost bushy.

Two specimens of this species in the South Australian Museum and received from Gater were measured and the Standard Data given by Womersley and Heaslip 1943.

Since then I have received a few specimens from Dr. S. H. Jayewickreme, of Colombo, and taken from *Rattus rattus kandiyanus*, at Embilipitiya, Ceylon, Jan., 1945 (Tube 13).

The Standard Data for 5 specimens are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	35·7±0·70	1·40±0·49	31·5–39·9	33·6–36·4	3·9
PW	51·8±1·81	3·61±1·28	41·0–62·6	47·6–56·0	7·0
SB	15·1±0·69	1·53±0·48	10·5–19·7	14·0–16·8	10·2
ASB	21·8±0·56	1·25±0·39	18·1–25·5	19·6–22·4	5·7
PSB	17·4±0·56	1·25±0·39	13·7–21·1	16·8–19·6	7·2
SD	39·2	No variation recorded.			
A–P	20·7±0·69	1·53±0·48	16·1–25·3	19·6–22·4	7·4
AM	25·2	No variation recorded.			
AL	18·9±0·70	1·40±0·49	14·7–23·1	16·8–19·6	7·4
PL	27·4±0·56	1·25±0·39	23·7–31·1	25·2–28·0	4·5
Sens.	28·0	Only one determination.			

This species is here placed in the subgenus *Neotrombicula* on its close homology with *T.* (*N.*) *spicea* which has been reared to the nymph.

TROMBICULA (NEOTROMBICULA) SPICEA (Gater 1932).

Trombicula spicea Gater 1932, Parasitol., 24, 143–174; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 78.

Trombicula (*Eutrombicula*) *spicea*, Sig Thor and Willmann 1947, Das Tierreich, Lfg. 71b, 288.

Eutrombicula n. sp. "A." Lawrence in MS. In Audy 1947. "Scrub Typhus Investigations in S.E. Asia, Pt. III. Appedix 7." AMD. 7. War Office, London.

Plate 17, fig. G–I.

Closely related to the preceding species, and differing therefrom as given under that species and as in the key.

The species was described from specimens from *Rattus malaisia* Kloss, from Sungei Buloh, Selangor, Federated Malay States.

The Standard Data was given by Womersley and Heaslip 1943 for a specimen received from Gater.

Recently I have received 4 specimens from *Rattus r. kandiyanus* from Embilipitiya, Ceylon, Jan., 1945 (S. H. Jayewickreme, No. 314 A.B.C.D.) which, although the sensillae are missing in all specimens, agree in the Standard Data with *spicea*. The Standard Data for these specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	46·9±1·76	3·52±1·24	36·4–57·4	42·0–50·4	7·5
PW	58·8±1·66	3·32±1·17	48·9–68·7	56·0–61·6	5·6
SB	17·5±0·70	1·40±0·49	13·3–21·7	16·8–19·6	8·0
ASB	25·2	No variation recorded.			
PSB	17·5±0·70	1·40±0·49	13·3–21·7	16·8–19·6	8·0
SD	42·7±0·70	1·40±0·49	38·5–46·9	42·0–44·8	3·3
A–P	25·9±1·34	2·68±0·95	17·9–33·9	22·4–28·0	10·3
AM	20·5±0·93	1·62±0·66	15·7–25·3	19·6–22·4	7·9
PL	32·8±1·34	2·68±0·95	24·8–40·8	30·8–36·4	8·1
Sens.	Missing.				

This species is here placed in the subgenus *Neotrombicula*, as larvae have been reared to the nymphal stage by Dr. S. H. Jayewickreme in Ceylon (see Adult Section).

The species referred to by T. J. Lawrence as *Eutrombicula* sp. n. "A" in Appendix 7 in Part III, Scrub-typhus Investigations in S.E. Asia, AMD 7, War Office 1947, are without doubt this species.

TROMBICULA (NEOTROMBICULA) CONSUETA sp. n.

Plate 110, fig. E–H.

Description of Larvae. Shape almost round. Length (engorged) 469μ, width 455μ. Scutum as figured, much wider than long with SB only slightly behind, or practically in line with PL; posterior margin sinuous and excavate medially; surface finely punctate; sensillae slightly thickening from base to apex and with long ciliations. Eyes 2 + 2, posterior the smaller. Chelicerae non-serrate, with only the apical tricuspid cap. Galeal setae nude. Palpi as figured, tibial claw bifurcate; all setae on femur, genu and tibia, except ventral on tibia, nude. Dorsal setae 36 in number, to 46μ long and arranged ca. 2.8.6.8.6.4.2, shortly ciliated and tapering. Ventrally with a pair of seta on maxillae, one on each coxa, a pair between coxae I and between coxae III and

thereafter 6.4.4.4.4.4.2, to 43μ long. Legs: I 241μ long, II 214μ, III 268μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data of two larvae and one larval pelt* are:

AW	PW	SB	ASB	PSB	SD	A–P	AM	AL	PL	Sens.
60·3	80·4	30·15	23·45	13·4	36·85	20·1	43·55	36·85	63·65	—
56·95	80·4	30·15	23·45	10·05	33·5	20·1	43·55	36·85	60·3	—
*53·6	—	30·15	23·45	10·05	33·5	20·1	43·55	33·5	63·65	53·6

Loc. and Hosts. Described from 2 larvae and 1 larval pelt* from *Rattus bowersi* from Ulu Langat Forest Reserve, Selangor, F.M.S., 13th June, 1950 (Scrub Typhus Research Unit).

Remarks. In general morphological features this species is closely related to *T. anous* and *T. pluvius,* but differs from these in the Standard Data and number of dorsal setae. It also differs from all other species of *Trombicula* s.l. in that the sensillae gradually thicken to the apex, but can hardly be regarded as lanceolate.

TROMBICULA PARMIFERA sp. n.

Plate 17, fig. J–M.

Description of Larvae. Shape broadly oval. Length (partially engorged) to 325μ, width to 235μ. Scutum shield-like, not much wider than long, posterior margin somewhat obtusely angular with the sides conxex but at extreme point forming a pronounced tip; surface finely punctate; setae fine and shortly ciliated, PL the longest, AL the shortest; sensillae filamentous with ciliations distally; sensillae bases wide apart, slightly nearer to line of PL than to line of AL. Eyes 2 + 2, posterior the smaller. Chelicerae strongly hook-like but with only the apical cap. Galeal setae nude. Palpi elongate, both femora and genu cylindrical, tibia very small and provided with two or a bifurcate claw, the prongs of which are short and stumpy, and do not reach the tip of palpal tarsus; setae on femur and genu fine and finely ciliated, on tibia all 3 apparently nude; tarsus with 4 or 5 ciliated setae. Dorsal setae fine and tapering, shortly ciliated, anteriorly 50μ, shortening posteriorly to 42μ, 20 in number and arranged 2.6.6.4.2. Ventrally with paired setae on maxillae, one on each coxa, those on I 42μ, on II 30μ, on III short and spine-like to 14μ; between coxae I and II a pair of fine setae, and thereafter 6.4.2.2.2 from 30μ anteriorly to 40μ posteriorly. Legs all 7-segmented, I 285μ long, II 250μ, III 273μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for the type and 28 paratypes are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	63·0±0·29	1·55±0·20	58·3–67·7	61·6–67·2	2·4
PW	73·25±0·27	1·48±0·19	68·8–77·7	70·0–75·6	2·0
SB	36·7±0·16	0·85±0·11	34·2–39·2	36·4–39·2	2·3
ASB	22·4	No variation recorded.			
PSB	38·3±0·31	1·66±0·24	33·3–43·3	36·4–42·0	4·3
SD	60·7±0·31	1·66±0·24	55·7–65·7	58·8–64·4	2·7
A–P	29·75±0·25	1·36±0·18	25·7–33·8	28·0–30·8	4·5
AM	45·6±0·43	2·17±0·31	39·1–52·1	42·0–47·6	4·7
AL	31·85±0·46	2·48±0·33	24·4–39·3	28·0–36·4	7·7
PL	49·5±0·41	2·18±0·29	43·0–56·0	44·8–53·2	4·4
Sens.	53·7±0·48	2·22±0·34	47·0–60·4	47·6–56·0	4·7

Loc. and Hosts. The type and 28 paratypes from a skink, *Mabuia multifasciata,* 11 Aug., 1949, from Bukit Lagong Forest Reserve, Kepong, near Kuala Lumpur, F.M.S. (J. R. Audy).

Remarks. This species is remarkable in the structure of the palpi, especially the cylindrical femora and genu, the very small tibia, and the short stumpy bifid palpal claws. These features, however, do not warrant the erection of a genus or subgenus until the nymph or adult of the species is known.

I am much indebted to Dr. J. R. Audy for the opportunity of studying the above material, as well as specimens of many other new species described herein.

TROMBICULA LUNDBLADI sp. n.

Plate 18, fig. A–D.

Description of Larvae. Shape broadly oval. Length (engorged) to 480μ, width to 420μ. Dorsal scutum as figured, with the posterior margin rather angular and extending well behind line of PL, surface lightly and irregularly pitted, SB nearer to line of PL than to AL, sensillae with 5 or 6 branches on distal half. Eyes 2 + 2, small, on ocular shields about 2 diams. from lateral scutal margins, posterior eyes about equal to anterior. Chelicerae curved, with the usual apical tricuspid cap. Galeal setae nude. Palpi stout, tibial claw bifurcate; all setae on femur, genu and tibia nude, tarsi with curved basal and longer subapical sensory rods and 5 or 6 ciliated setae, one of which is longer than the rest and over-reaches tip of claw. Dorsal setae rather stiff and moderately thick, with short ciliations, to 36μ long and arranged 2.6.6.4.2.2. Ventrally with the usual pair of branched setae on gnathosoma, a single fine, shortly ciliated seta on each coxa, a pair between coxae I and between coxae III and thereafter 4.2.2.2; ventral setae between coxae 16μ, at posterior end 30μ. Legs: I 230μ, II 195μ, III 230μ; tarsi I and II with the usual dorsal rod-like seta, III without a long nude seta.

The Standard Data in microns for 13 specimens from the type series are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	70·85±0·39	1·34±0·26	66·8–74·9	70·0–72·8	1·9
PW	78·2±0·21	0·78±0·15	75·9–80·5	75·6–78·4	1·0
SB	41·6±0·29	1·05±0·20	38·5–44·7	39·2–42·0	2·5
ASB	23·9±0·40	1·45±0·28	19·6–28·2	22·4–25·2	6·6
PSB	36·4	No variation recorded.			
SD	60·3±0·40	1·45±0·28	56·0–64·6	58·8–61·6	2·4
A–P	27·6±0·29	1·05±0·20	24·5–30·7	25·2–28·0	3·8
AM	21·5±0·49	1·76±0·34	16·3–26·7	19·6–25·2	8·2
AL	21·1±0·40	1·45±0·28	16·8–25·4	19·6–22·4	6·9
PL	19·6	No variation recorded.			
Sens.	42·0	Only one determination.			

Loc. From under the scales of a dark green and striped skink from Hollandia, Dutch New Guinea, 8 Dec., 1944 (C. B. Philip).

Remarks. This is a distinct and rather characteristic species in the shape of the dorsal scutum and in the small and fine scutal setae. It is named in honour of Dr. C. Lundblad, the eminent Swedish Hydrachnologist.

TROMBICULA (LEPTOTROMBIDIUM) BODENSIS (Gunther 1940).

Trombicula bodensis Gunther 1940, Proc. Linn. Soc. N.S.W., 65 (5–6), 479; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 87.

Plate 18, fig. E–H.

Gunther described this species from colonies on the legs of the mouse deer (*Tragulus borneanus* Miller) from the Bode River, near Sandakan, British North Borneo.

I have recently been able to study a lot of material of this species collected by Maj. R. N. McCulloch, from the mouse deer at Kuching, Sarawak, 22 Sept., 1945, and also from rats at Labuan, British North Borneo, in June and Oct., 1945, and from Balikpapan in Dutch Borneo, 21 Aug., 1945.

The specimens conform well with the original description and the following re-description is now given based on this additional material.

Re-description of Larvae. Shape broadly oval. Length (only slightly engorged) 300μ, width 230μ. Dorsal scutum almost rectangular with the anterior and posterior margins almost straight as figured, surface lightly and sparsely pitted, scutal setae fairly stout and ciliated; sensillae placed a little in front of a line joining PL, and with 6–7 long outstanding branches on distal third. Eyes 2 + 2, anterior the larger. Chelicerae as figured, with the usual tricuspid cap. Galeal setae slender and with 6–7 long branches as figured. Palpi stout; all setae on femur, genu and tibia except the dorsal tibial nude.

Palpal claw bifurcate. Palpal tarsus with the usual sensory rods and 5–6 ciliated setae. Dorsal setae, moderately thick, only slightly curved and ciliated, to 60μ long, and arranged 2.8.6.6.6.2(4). Ventrally, with the usual pair of gnathosomal ciliated setae, a single seta on each coxa, a pair between coxae I and between coxae III and then approximately 10(8),4(8),4.4.4. Legs: I 180μ, II 125μ, III 200μ; tarsi I and II with the usual dorsal rod-like setae; no long nude seta on tarsi III.

The following Standard Data in microns, is derived from 2 paratypes and 14 recent specimens:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	60·2±0·33	1·45±0·27	55·8–64·6	58·8–61·6	2·4
PW	68·8±0·64	2·38±0·45	61·7–75·9	64·4–72·8	3·5
SB	28·8±0·35	1·31±0·24	24·9–32·7	28·0–30·8	4·6
ASB	28·0	No variation recorded.			
PSB	11·2	No variation recorded.			
SD	39·2	No variation recorded.			
A–P	28·0	No variation recorded.			
AM	50·0±0·53	1·92±0·37	44·2–55·8	47·6–53·2	3·8
AL	43·4±0·39	1·45±0·27	19·0–27·8	42·0–44·8	6·2
PL	55·6±0·82	3·08±0·58	46·4–64·8	50·4–61·6	5·5
Sens.	61·6±0·72	1·77±0·55	56·3–66·9	58·8–64·4	2·9

Remarks. This species may be separated as in the revised key. In the bifurcate palpal claw it would fall in *Eutrombicula* Ewing 1938, and in the number of dorsal setae into *Acariscus* Ewing 1943, but these genera are not now recognized as valid.

It is here placed in the subgenus *Leptotrombidium* on the structrue of the longitudinally divided sternum formed by the precoxal plates of leg I, in the nymph.

A more recent collection from *Callosciurus hippurus,* from Kuching, Sarawak, 1950, and received from Dr. J. R. Audy, has the following Standard Data derived from 23 specimens:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	59·7±0·39	1·89±0·28	54·0–65·4	56·95–63·65	3·2
PW	68·25±0·39	1·88±0·28	62·6–73·9	67·0–73·7	2·7
SB	27·25±0·23	1·13±0·17	23·85–30·65	26·8–30·15	4·1
ASB	30·15	No variation recorded.			
PSB	13·4	No variation recorded.			
SD	43·55	No variation recorded.			
A–P	27·25±0·23	1·13±0·17	23·85–30·65	26·8–30·15	4·1
AM	49·2±0·60	2·87±0·42	40·6–57·8	46·9–56·95	5·8
AL	38·5±0·47	2·23±0·33	31·8–45·2	36·85–43·55	5·8
PL	49·2±0·70	3·34±0·49	39·2–59·2	46·9–56·95	6·8
Sens.	67·2±0·23	0·86±0·16	64·6–69·8	67·0–70·35	1·3

TROMBICULA NISSANI Dumbleton 1947.

Trans. Roy. Soc. N. Zealand, 76, 412.

Plate 18, fig. I–K.

This species was described from the type and paratype from a "Cuscus" from Nissan Island (Green Is.), Territory of N. Guinea, 28 April, 1944 (coll. L.J.D.). The type is deposited in the South Australian Museum.

The dorsal scutum is almost rectangular with the posterior margin only very slightly convex behind PL. Sensillae bases in front of PL, but very much nearer to line of PL than AL. Scutal setae thick and with short ciliations or serrations, AM the shortest. Eyes 2 + 2, on distinct ocular shields, posterior eyes the smaller. Chelicerae with only the apical tricuspid cap. Galeal setae nude. Palpal tibial claw trifurcate (not *bifid* as given by Dumbleton); setae on palpal femur and genu branched, on tibia all 3 nude. The DS are 28 in number, to 55μ long, and arranged 2.8.6.6.4.2. All coxae unisetose. Tarsi of leg III without any long nude seta.

The Standard Data of the type and paratype are: AW 66·0, 65·0, PW 69·0, 69·0, SB 23·0, 23·0, ASB 26·0, 26·0, PSB 13·0, 13·0, SD 39·0, 39·0, A–P 29·0, 29·0, AM 26·0, 26·0, AL 36·0, 33·0, PL 46·0, 43·0, Sens. 36·0, —. (after Dumbleton).

TROMBICULA ISSHIKII Sugimoto 1938.

Trombicula isshikii Sugimoto 1938, J. Jap. Soc. Vet. Sci., 17, (1), 57–62, fig. 1–3.

Trombicula isshikii Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 81.

Plate 18, fig. L–M.

Owing to unfamiliarity with the Japanese writing, the data given in Womersley and Heaslip's 1943 paper, and derived from Sugimoto's paper (it had no summary in English or any other language) were in error.

I have recently had the essential details translated by a Japanese student, and the following description is based on this translation.

"Shape oval to circular. Colour red. Chelicerae not serrated. Galeal setae nude. Palpi with ciliated setae on femur, genu, and dorsally on tibia; tarsi with 6 comb-like setae, tibial claw bifurcate with the upper prong longer than lower. Dorsal scutum trapezoidal, the front and side margins convex, posterior margin rounded.

"Scutal setae fine, comb-like; the PL setae very long, AM and AL of equal length. SB somewhat nearer to posterior than to anterior scutal mar-

gin. Sensillae with five branches. Eyes 2 + 2, on ocular shields, not far from scutal margins, anterior eyes with a distinct cornea, posterior eyes the smaller. Dorsal setae small, comb-like. Total setae 42–44, with 26 on dorsum, arranged 2.6.6.6.4.2; anterior longer than posterior. Ventral setae arranged 2.2.4.4.4.2, longer posteriorly than anteriorly. Legs: tarsi I and II rapidly tapering, coxae II and III separated, the longer leg setae serrated and comb-like.

"Body length 0·49–0·59 mm., width 0·41–0·44 mm. Length of palpi 94μ, of chelae 42μ. Scutal length 55μ, width 78μ. SB 31μ, AM 58μ, AL 43μ, PL 74–78μ, Sens. 97μ, Tarsi I 34μ."

Remarks. In the bifurcate palpal claw and the number of DS, *isshikii* would come into *Acariscus* Ewing, although the ciliated dorsal setae of the palpal tibia shows some relationship with the *akamushi-deliensis* group. The convex anterior and lateral scutal margins are also unusual. No material has been seen.

Type Loc. and Host. Naikosho, Shichiseigum, Pref. Taihoku, Formosa, on *Capella hardwickii* (Gray). Type in Taihoku Imperial University Museum.

TROMBICULA (NEOTROMBICULA) SCINCOIDES (Wom. 1944).

Trombicula scincoides Womersley 1944, Tr. Roy. Soc. S. Aust., 68, (1), 84.

Plate 19, fig. A–E.

This species was originally described from a series of 15 specimens from a skink, *Lygosoma* (*Leiolopisma*) *bicarinatus* (MacL. 1877) from New Guinea, Oct. 1, 1943 (R. N. McCulloch). The specimens are now, after the lapse of time, somewhat more flattened, and the values of the Standard Data slightly greater than originally given. The newly measured values for 13 specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	98·2±0·51	1·86±0·36	92·6–103·8	95·2–100·8	1·9
PW	113·5±0·60	2·17±0·43	107·0–120·0	112·0–117·6	1·9
SB	51·05±0·34	1·23±0·24	47·4–54·7	50·4–53·2	2·4
ASB	28·0±0·33	1·14±0·23	24·6–31·4	25·2–30·8	4·1
PSB	26·6±0·39	1·40±0·27	22·4–30·8	25·2–28·0	5·2
SD	54·6±0·54	1·93±0·38	48·8–60·4	50·4–58·8	3·5
A–P	30·4±0·43	1·55±0·30	25·7–35·1	28·0–33·6	5·1
AM	39·9±0·50	1·74±0·35	34·7–45·1	36·4–42·0	4·3
AL	39·2±0·32	1·14±0·22	35·8–42·6	36·4–42·0	2·9
PL	47·6±0·32	1·14±0·22	44·2–51·0	44·8–50·4	2·4
Sens.	57·4±0·65	2·23±0·46	50·7–64·1	56·0–61·6	3·9

The chelicerae have the usual tricuspid cap only and the galeal setae are nude. The tibial claws of the palpi are bifurcate; the seta on the palpal femur

with a few short branches, often appearing nude; on the genu nude and on the tibia only the ventral seta is branched. There is no long nude outstanding seta on tarsi on leg III.

Another population of 34 specimens from Hollandia, Dutch New Guinea, from various skinks, collected Nov. and Dec., 1944 by Lt.-Col. C. B. Philip (No. 5, 6 and 7) are not different morphologically from the type series, except that the scutum is considerably larger, all the Standard Data being significantly greater at 0·1% probability, except PW, which is significantly greater at 2% level. (Sens. were not compared.)

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	105·4±0·51	2·94±0·36	96·6–114·2	98·0–112·0	2·8
PW	116·7±0·75	4·33±0·53	103·7–129·7	109·2–126·0	3·7
SB	55·1±0·32	1·89±0·23	49·4–60·8	53·2–58·8	3·4
ASB	30·8±0·26	1·50±0·18	26·3–35·3	28·0–33·6	4·8
PSB	28·0	No variation recorded.			
SD	58·8±0·26	1·50±0·18	54·3–63·3	56·0–61·6	2·5
A–P	32·8±0·23	1·36±0·16	28·7–36·9	28·0–33·6	4·1
AM	46·95±0·27	1·39±0·19	42·8–51·1	44·8–50·4	3·0
AL	44·0±0·28	1·60±0·20	39·2–48·8	42·0–47·6	3·6
PL	51·3±0·29	1·64±0·20	46·4–56·2	47·6–56·0	3·2
Sens.	67·2 Aver. of only 2 determinations, 64·4 and 70·0.				

As discussed further on, it seems hardly justified to consider this population as more than a race or form of *scincoides.*

To the typical form can be referred the following additional specimens:

New Guinea: Nadzab, on boots, 21 Dec., 1942 (1 spec.); Burma, Jan., 1944, on boots (2 specs.); Lae, 9 March, 1944, and 3 May, 1944 (2 specs.), (R.N.McC.); Goodenough Is., N.G., 18 Jan., 1944 on boots (D.C.S.), (4 specs.).

Bougainville: On a gecko, 4 July, 1944 (G. W. Wharton), Nambru, II. 44 (1 spec.).

Philippine Is.: Mindoro, Mts. near San Juan, 11 Apr., 1945, on mottled skink (2 specs.) (C.B.P.)

This species is placed in the subgenus *Neotrombicula* on the adult characters. It is closely related to the two following species, which are only separated from it, on the very much greater differences in scutal dimensions, than occur between the typical populations of *scincoides* and its form from Hollandia, D.N.G.

The Standard Data of the population of *scincoides* from Hollandia are approximately intermediate between those of typical *scincoides* and those of *kohlsi,* and while all three populations are widely significantly different it is possible they may be only populations of the one species.

TROMBICULA (? NEOTROMBICULA) KOHLSI (Wom. 1944).

Trombicula kohlsi Womersley 1944, Tr. Roy. Soc. S. Aust., 68, (1), 87.

Plate 19, fig. F–G.

Originally described from a series of 7 specimens collected on boots amongst Kunai grass, Buna area of New Guinea, 1943 (G. M. Kohls), this species differs from *T.* (*N.*) *scincoides* (Wom.) and its form from Hollandia only in the very much larger dimensions of the Standard Data.

The Standard Data of these specimens as remeasured are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	110·8±1·03	2·73±0·73	102·6–119·0	106·4–114·8	2·5
PW	124·4±0·56	1·49±0·40	119·9–128·9	123·3–126·0	1·2
SB	62·4±0·80	2·12±0·56	56·1–68·7	58·8–64·4	3·4
ASB	34·8±0·56	1·49±0·40	30·3–39·3	33·6–36·4	4·3
PSB	33·6	No variation recorded.			
SD	68·4±0·56	1·49±0·40	63·9–72·9	67·2–70·0	2·2
A–P	36·8±0·40	1·06±0·28	33·6–40·0	36·4–39·2	2·8
AM	45·6±0·52	1·37±0·36	41·5–49·7	44·8–47·6	3·0
AL	47·6±0·61	1·61±0·43	42·8–52·4	44·8–50·4	3·4
PL	55·6±0·40	1·06±0·28	52·4–58·8	53·2–56·0	1·9
Sens.	63·6±0·52	1·37±0·36	59·5–67·7	61·6–64·0	2·1

The relationship of this species to *scincoides* and *tovelli* is discussed below.

TROMBICULA (? NEOTROMBICULA) TOVELLI sp. n.

Plate 19, fig. H–J.

Description of Larvae. Shape an elongate oval. Length, partly engorged to 420μ, width 339μ. Dorsal scutum as figured with finely striate-punctate surface, anterior margin sinuous, posterior evenly curved and not very deep, SB nearer to line of PL than to AL. Eyes 2 + 2, on well developed ocular shields, the posterior eyes the smaller. Chelicerae with the usual apical tricuspid cap. Palpi stout, with bifurcate tibial claw. Seta on palpal femur with a few fine short indistinct branches; on genu nude; on tibia dorsal and lateral nude, ventral branched; tarsi with basal and subapical rods and 5–6 ciliated setae, one of which over-reaches tip of tibial claw. Galeal setae nude. Dorsal setae stiff, with short ciliations, 20–22 in number and arranged 2.6.6.4.2(2) to 35μ long. Ventrally with the usual pair of branched setae on gnathosoma, a ciliated seta on each coxa, a pair between coxae I and between coxae III, and thereafter 6.2.2.2, to 30μ long. Legs: I 240μ long, II 225μ, III 240μ; tarsi I and II with dorsal sensory rod, and III without any long nude seta.

The Standard Data are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	77·9±0·47	1·14±0·33	74·5–81·3	75·6–78·4	1·5
PW	89·1±0·47	2·75±0·33	85·7–92·5	84·0–92·4	1·3
SB	40·1±0·93	2·28±0·66	33·25–46·95	36·4–42·0	5·7
ASB	27·1±0·59	1·45±0·42	22·8–31·4	25·2–28·0	5·3
PSB	25·7±0·47	1·14±0·33	22·3–29·1	25·2–28·0	4·4
SD	52·7±0·47	1·14±0·33	49·3–56·1	50·4–53·2	2·2
A–P	26·1±0·59	1·45±0·42	21·8–30·4	25·2–28·0	5·5
AM	29·4±0·63	1·53±0·44	24·8–34·0	28·0–30·8	5·2
AL	30·8	No variation recorded.			
PL	41·5±0·47	1·14±0·33	38·1–44·9	39·2–42·0	2·7
Sens.	56·0	No variation recorded. Two determinations only.			

Another population of eight specimens from a lizard, taken 60 miles south of Darwin, N.T., Aust., 30 May, 1943 (R. V. Southcott) has the following Standard Data:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	72·8±0·53	1·49±0·37	68·3–77·3	70·0–75·6	2·0
PW	86·1±0·48	1·35±0·34	82·05–90·15	84·0–86·8	1·6
SB	37·1±0·48	1·35±0·34	33·05–41·15	36·4–39·2	3·6
ASB	25·2	No variation recorded.			
PSB	25·2	No variation recorded.			
SD	50·4	No variation recorded.			
A–P	25·2	No variation recorded.			
AM	26·25±0·51	1·45±0·36	21·9–30·6	25·2–28·0	5·5
AL	30·45±0·63	1·79±0·45	25·05–35·85	28·0–33·6	5·9
PL	39·2±0·53	1·49±0·37	34·7–43·7	36·4–42·0	3·8
Sens.	53·2±0·61	1·61±0·43	48·4–58·0	50·4–56·0	3·0

A third population from a skink, *Sphenomorphus taeniolatus* from Groote Eylandt, Arnhem Land Expedition, 1945, has the Standard Data significantly greater than the type series. As measured for 11 specimens, these are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	83·5±0·51	1·69±0·36	78·4–88·6	81·2–86·8	2·0
PW	96·5±0·69	2·29±0·49	89·7–103·3	92·4–100·8	2·4
SB	42·5±0·63	2·10±0·45	36·2–48·8	39·2–44·8	5·0
ASB	26·7±0·25	1·46±0·31	22·3–31·1	25·2–28·0	5·5
PSB	27·7±0·25	1·84±0·18	25·2–30·2	25·2–28·0	3·0
SD	54·5±0·44	1·46±0·31	50·1–58·6	53·2–56·0	2·7
A–P	28·25±0·25	0·84±0·18	25·75–30·75	28·0–30·8	3·0
AM	28·5±0·34	1·13±0·24	25·1–31·9	28·0–30·8	4·0
AL	33·6	No variation recorded.			
PL	41·2±0·55	1·81±0·38	35·8–46·6	39·2–44·8	4·4
Sens.	58·45±0·82	2·34±0·58	51·45–65·45	56·0–61·6	4·0

Morphologically, *tovelli* and its two other populations, do not differ from *scincoides* except in the very much smaller size of the scutum, the significance of which is discussed below.

Comparison of the Species *T. scincoides* Wom., *kohlsi* Wom. and *tovelli* sp. n.

In trying to evaluate specifically the differences in the Standard Data of these three species and their several populations, resort has been made to showing the Mean, Range of Mean as expressed by $M \pm 3\sigma_M$, Theoretical Range $M \pm 3 \times$ Standard Deviation, $M \pm 2S.$, and Observed Range, in Graph form; and also by a statistical comparison of the Difference of Means, with a value of "t" calculated for each item of Standard Data, all populations being referred to the type population of *scincoides*. Those of *tovelli* from 60 miles south of Darwin, and from Groote Eylandt are also compared with the type series of *tovelli*.

	Compared with type series of *scincoides*										Compared with type series of *tovelli*			
	scincoides ex Hollandia		*kohlsi*		*tovelli* type series		*tovelli* 10 mls. S. of Darwin		*tovelli* ex Groote Eylandt		*tovelli* 60 mls. S. of Darwin		*tovelli* ex Groote Eylandt	
	n.	t.	n.	t.	n.	t.	n.	t.	n.	t.	n.	t.	n.	t.
AW	44	+ 8·05	18	+12·23	17	—12·29	19	—36·52	22	—20·12	12	— 6·94	15	+7·23
PW	44	+ 2·49	18	+11·76	17	—20·95	19	—32·12	22	—18·6	12	—2·73	15	+5·94
SB	45	+ 7·06	18	+15·32	17	—13·75	19	—24·79	22	—12·40	12	—3·12	15	+2·19
ASB	45	+ 5·94	18	+16·78	17	— 1·47	19	— 6·86	22	— 2·44	12	—3·77	15	—0·54
PSB	45	+ 5·94	18	+13·06	17	— 1·37	19	— 2·80	22	— 2·27	12	—1·25	15	+4·32
SD	45	+ 7·78	18	+16·35	17	— 2·21	19	— 6·08	22	— 0·14	12	—5·77	15	+2·60
A–P	45	+ 5·14	18	+ 9·69	17	— 5·72	19	— 9·37	22	— 4·09	12	—3·77	15	+3·92
AM	37	+13·36	17	+ 7·40	16	—16·79	18	—16·35	21	— 2·26	12	—4·09	15	—1·38
AL	43	+ 9·73	18	+13·5	17	—19·4	19	—13·73	22	—16·19	12	—0·47	No variation	
PL	44	+ 7·33	18	+15·3	17	—10·8	19	—14·55	22	—10·52	12	—3·13	15	—0·36
Sens.	—	—	17	+ 6·61	16	— 1·51	17	— 4·33	18	— 1·01	11	—4·30	12	+2·54

It is evident from this table and from the graph that while all these populations differ very significantly from one another at the 0·1% level of probability, at least two groups may be separated biometrically and on a specific level, the one with the largest scuta including *scincoides* and its population from Hollandia as well as *kohlsi;* the other including *tovelli* and its two populations.

TROMBICULA JUBBULPORENSIS sp. n.

Plate 20, fig. A–B.

Description of Larva. Shape ? Length and width ? Scutum as figured with AW very much shorter than PW and lateral margins strongly divergent posteriorly; sensillae ?, their bases very wide apart; posterior scutal margin lightly concave between PL, almost rectilinear; AL the shortest, PL the longest. Eyes ? Chelicerae with only the apical tricuspid cap. Galeal setae nude. Palpi stout, tibia claw bifurcate; seta on femur and genu ciliated, on tibia only the ventral ciliated. Dorsal setae to 30μ long, ca. 38 in number and arranged 2.8.6.6.6.6.4. Ventrally with a pair of ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, thereafter ? Legs: tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for the unique type are: AW 56·0, PW 86·8, SB 44·6, ASB 28·0, PSB 12·0, SD 40·0, A–P 50·4, AM 25·22, AL 22·4, PL 50·4, Sens. —.

Loc. and Host. A single specimen from a rat, Jubbulpore, India, April, 1947 (S. L. Kalra).

Remarks. As the type was inadvertently damaged under oil immersion only a few details are figured. The species should, however, be easily recognized again on the characteristic scutum, etc.

TROMBICULA KHURDANGENSIS sp. n.

Plate 20, fig. C–D.

Description of Larva. Shape engorged, elongate oval, with slight constriction behind coxae III. Length 585μ, width 325μ. Scutum as figured, roughly pentagonal but the posterior angle rather shallow, lateral margins divergent posteriorly; AM in front of line of AL and AL well back from the rounded antero-lateral shoulders; sensillae filamentous and ciliated on distal two-thirds, their bases midway between lines of AL and PL; AL the shorter and PL the longer. Eyes not seen. Chelicerae with only the apical tricuspid cap. Galeal setae nude. Palpi stout, tibial claw bifurcate; all setae on femur, genu and tibia ciliated or branched. Dorsal setae strong, curved and distinctly ciliated, 44 in number, to 38μ long and arranged 2.4.6.6.4.6.6.4.4.2. Ventrally with a pair of ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, and thereafter 8.6.8.8.8.6.6.4.2. to ca. 32μ long. Legs: I 260μ long, II 247μ, III 286μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for the unique type are: AW 61·6, PW 73·0, SB 22·4, ASB 28·0, PSB 28·0, SD 56·0, A–P 30·0, AM 36·4, AL 30·8, PL 47·6, Sens. 64·4.

Loc. and Host. A single specimen from a rat from Khurdang, Kashmir, July, 1949 (S. L. Kalra).

Remarks. This species in the general form of the scutum is closely allied to *T. rajoriensis* sp. n., but differs in the Standard Data, the number and structure of the dorsal setae, and the unisetose coxa III.

TROMBICULA RAJORIENSIS sp. n.

Plate 20, fig. G–K.

Description of Larva. Shape (engorged) elongate oval with slight constriction behind coxae III. Length 585μ, width 455μ. Scutum as figured, pentagonal with lateral margins almost parallel; sensillae filamentous, ciliated on distal half and with their bases in front of line of PL; margins of posterior angle lightly concave; AM in front of line of AL and AL rather back from the rounded antero-lateral corners; AL the shortest, PL the longest. Eyes not seen. Chelicerae with only the apical tricuspid cap. Galeal setae branched or ciliated. Palpi stout, tibial claw bifurcate; all setae on femur, genu and tibia ciliated. Dorsal setae stiff and rather spine-like, curved, with short barbs, 34 in number, to 56μ long, and arranged 2.8.8.6.4.4.2. Ventrally with a pair of ciliated setae on maxillae, one on coxae I and II, and two on coxae III, a pair between coxae I and between coxae III and thereafter ca. 50 setae, arranged ca. 2.6.6.6.6.6.6.6.4.2, to 40μ long, and shortly ciliated, not barbed. Legs: I 286μ long, II 260μ, III 300μ; tarsi I and II with the dorsal sensory rod (spur), III without any long nude seta.

The Standard Data for the unique type are: AW 53·2, PW 56·0, SB 22·4, ASB 30·8, PSB 33·6, SD 64·4, A–P 28·0, AM 40·0, AL 25·2, PL 50·4, Sens. 56·0.

Loc. and Host. A single specimen from a rat from Rajori, Kashmir, India, May, 1948 (S. L. Kalra).

TROMBICULA KASHMIRENSIS sp. n.

Plate 20, fig. E–F.

Description of Larvae. Shape (engorged) elongate oval with tendency to constriction behind coxae III. Length to 520μ, width to 429μ. Scutum as figured, with posterior margin deeply angular, giving a pentagonal shape;

PL the longest; sensillae bases only slightly in advance of line of PL; scutal surface finely punctate. Eyes 2 + 2, posterior the smaller. Chelicerae with only the apical tricuspid cap. Galeal setae nude. Palpi stout with trifurcate tibial claw; setae on palpal femur and genu ciliated, on tibia only the ventral branched or ciliated. Dorsal setae 44 in number, to 47μ long and arranged ca. 2.13.9.8.5.5.2. Ventrally with paired ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter 6.6.4.4.4.6.4.2, to 30–40μ long. Legs: I 325μ long, II 286μ, III 325μ; tarsi I and II with usual dorsal rod, III without any long nude seta; telofemur of all legs with a long outstanding ciliated seta, somewhat longer than the other seta but not so long as in *T. kanzalwanensis* sp. n.

The Standard Data for the type and 3 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	81·9±0·70	1·40±0·49	77·7–86·1	81·2–84·0	1·7
PW	98·7±0·70	1·40±0·49	94·5–102·9	98·0–100·8	1·4
SB	34·65±0·67	1·34±0·47	30·65–38·65	33·6–36·4	3·8
ASB	29·4±0·81	1·61±0·57	24·6–34·2	28·0–30·8	5·5
PSB	33·6	No variation recorded.			
SD	63·0±0·81	1·61±0·57	58·2–67·8	61·6–64·4	2·5
A–P	30·8	No variation recorded.			
AM	42·0±1·14	2·29±0·81	35·1–48·9	39·2–44·8	5·4
AL	42·7±0·70	1·40±0·49	38·5–46·9	42·0–44·8	3·3
PL	54·6 (Aver. of two determinations only, viz. 53·2 and 56·0)				
Sens.	84·0	One determination only.			

Loc. and Hosts. Four specimens from a rat from Khurdang, Kashmir, India, July, 1949 (S. L. Kalra).

Remarks. Very similar in scutum to *T. kanzalwanensis,* but easily separated as in the key on the absence of a long nude seta on tarsi of leg III, and in the arrangement of dorsal setae.

TROMBICULA MURIDIA sp. n.

Plate 20, fig. L–M.

Description of Larva. Scutum transversely rectangular, as figured with posterior margin an even but shallow curve behind line of PL; sensillae bases in line of PL; sensillae filamentous and ciliated in distal half; PL the longest. Eyes? Chelicerae with only the apical tricuspid cap. Galeal setae branched. Palpi with bifurcate tibial claw; seta on femur and genu branched; setae on tibia nude except the dorsal. Dorsal setae 26 in number, to 53μ long, and

arranged 2.8.6.6.4. Ventrally with paired ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, thereafter uncertain. Legs, tarsi of III without any long nude seta; of I and II with dorsal sensory rod.

The Standard Data for the unique type are: AW 58·8, PW 72·8, SB 32·0, ASB 28·0, PSB 12·0, SD 40·0, A–P 22·4, AM 53·2, AL 56·0, PL 64·0, Sens. 60·0.

Loc. and Host. A single specimen from *Rattus mulleri,* No. 7646, from Bukit Lagong, Kepong, F.M.S., 25 July, 1950 (J.R.A.).

Remarks. The unique example of this species was unfortunately damaged in remounting, and consequently entire dorsal and ventral figures are not given, and the description lacks certain details. The scutum, and the palpal setation, however, will enable the species to be again recognized.

In the key, it will run down to near to *T. sylvestris* Audy and Traub 1950, from which it is easily separated.

TROMBICULA TAPHOZOUS sp. n.

Plate 21, fig. A–B.

Description of Larva. Length (engorged) 650μ, width 455μ. Scutum as figured; sparsely punctate, the punctations fairly large; anterior margin shorter than posterior, and lightly concave between AM and AL; posterior margin shallow behind line of PL, and concave, almost rectilinear laterally on each side from PL for a quarter of its length, then deepening to a lightly sinuous curve; sensillae filamentous, ciliated distally and their bases in front of PL; PL the longest, AM the shortest. Eyes ? 2 + 2. Chelicerae missing. Galeal setae nude. Palpi as figured; palpal claw trifurcate; seta on femur nude or shortly and indistinctly ciliated, on genu apparently nude, on tibia all 3 setae apparently nude. Dorsal setae difficult to ascertain owing to displacement, but ca. 2 plus 5 rows of about 10, plus 8.6.4. or ca. 70 in number, to 30μ long. Ventrally with a pair of ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 50 +, to 28μ long. Legs: I 286μ, II 260μ, III 300μ; tarsi I and II with dorsal rod, III without any long nude seta.

The Standard Data for the unique type are: AW 64·4, PW 87·0, SB 19·6, ASB 33·6, PSB 14·0, SD 47·6, A–P 39·2, AM 20·0+, AL 40·0, PL 50·4, Sens. 56·0.

Loc. and Host. A single specimen from bat, *Taphozous melanopogon,* R.9626, No. 13062 from Palau Seletan Is. (P. Angsa), Malaya, 1/2/50, (J.R.A.).

Remarks. In the key this species comes near to *densipiliata,* from which it differs in the shape of scutum, the nude setae on palpal femur and genu, and the number of dorsal setae.

TROMBICULA TITHWALENSIS sp. n.

Plate 21, fig. C–G.

Description of Larvae. Length (engorged) 520μ, width 520μ. Shape rounded. Scutum large, finely punctate as figured, with SB slightly behind line of PL, and AM well back from line of AL almost midway between line of AL and PL; PL a little longer than AL; sensillae ciliated distally. Eyes 2 + 2, rather small, and posterior eyes the smaller. Chelicerae missing. Galeal setae branched. Palpi with bifurcate tibial claw; setae on femur and genu nude, on tibia both dorsal and ventral branched, lateral nude. Dorsal setae ca. 42, arranged 2.12.8.8.6.4.2, from 70μ long anteriorly to 56μ posteriorly. Ventral with a pair of maxillary ciliated setae, one on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 36, increasing in length posteriorly. Legs: I 260μ long, II 234μ, III 286μ; tarsi I and II with dorsal sensory rod; tarsi III without any long nude seta.

The Standard Data for the unique type and 3 other specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	83·2±0·70	1·40±0·49	79·1–87·5	81·2–84·0	1·7
PW	93·8±0·81	1·61±0·57	89·0–89·6	92·4–95·2	1·7
SB	36·4±1·14	2·28±0·81	29·6–43·2	33·6–39·2	6·3
ASB	35·0±0·81	1·61±0·57	30·2–39·8	33·6–36·4	4·6
PSB	16·1±0·70	1·40±0·49	11·9–20·3	14·0–16·8	8·7
SD	51·1±1·34	2·68±0·95	43·1–59·1	47·6–53·2	5·2
A–P	28·7±1·34	2·68±0·95	20·7–36·7	25·2–30·8	9·3
AM	51·3±2·46	4·27±1·74	38·5–64·1	47·6–56·0	8·3
AL	47·6	No variation recorded.			
PL	58·1±1·34	2·68±0·95	50·1–66·1	56·0–61·6	4·6
Sens.	78·4	Only one determination.			

Loc. and Host. A single specimen from ear of rat, Tithwal, India, Sept. 1948 (S.L.K.), and 3 specimens from a "mouse" from Baltal, Kashmir.

Remarks. This species appears closest to *bhimtalensis* sp n. but differs in the dorsal setae, and Standard Data. In the illustration of the scutum the sensillae are erroneously shown as nude. The posterior scutal margin should also be shown as lightly concave laterally from PL and medially almost straight.

TROMBICULA BUXTONI sp. n.

Plate 22, fig. A–F.

Description of Larvae. Shape an elongate oval, widest in anterior third and slightly constricted behind coxae III. Length (engorged) to 525μ, width to 327μ. Scutum small, roughly quadrate, but the posterior margin forming a shallow angle; AL placed well behind antero-lateral corners; anterior margin concave and AM well in front of AL. Sensillae long and filamentous, ciliated for their whole length, with their bases in front of PL. Eyes 2 + 2, the posterior the smaller. Chelicerae non-serrate, with only the apical tricuspid cap. Galeal setae nude. Palpal claw trifurcate; setae on palpal femur, genu and tibia all strongly ciliated. Dorsal setae thick, and strongly ciliated, to 48μ long, and arranged 2.6.6(4).4(6).4.2.2. Ventrally with a pair of ciliated setae on maxillae, one on each of coxae I and II, two on each of coxae III, a pair between coxae I and between coxae III, and thereafter ca. 38 setae to 32μ long. Legs: I 285μ long, II 241μ, III 312μ; tarsi I and II with the usual dorsal sensory rod, III with a long fine nude seta, not easy to see and not as long as the ordinary setae.

The Standard Data derived from seven of eight specimens, are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	45·3±0·83	2·21±0·59	38·7–51·9	41·6–48·0	4·8
PW	46·6±0·65	1·71±0·46	41·5–51·7	44·8–48·0	3·7
SB	18·7±0·29	0·78±0·21	16·4–21·6	17·6–19·2	4·2
ASB	28·8	No variation recorded.			
PSB	22·4	No variation recorded.			
SD	51·2	No variation recorded.			
A–P	25·6	No variation recorded.			
AM	38·4	No variation recorded.			
AL	22·4	No variation recorded.			
PL	41·6	No variation recorded.			
Sens.	54·7±1·06	2·37±0·75	47·6–61·8	51·2–57·6	4·3

Loc. and Host. Eight specimens (the type and 7 paratypes) from a yellow coloured rat from Ranikhet, Kumaon Hills, India, Oct. 1946 (S. L. Kalra).

Remarks. A very characteristic species in the shape and dimensions of the scutum, the 2-setose coxae III, the dorsal setae, and the setation of the palpi. It can be distinguished as in the key.

TROMBICULA NAULTINI Dumbleton 1947.

Trans. Roy. Soc. N. Zealand, 1947, 76, 412.

Plate 22, fig. G–J.

The type and paratype of this species were from a gecko *Naultinus elegans* Gray, from Invercargill, N. Zealand (coll. B. B. Given, no date). Dumbleton

records also six other specimens as "Parasitic on a Gecko, Big Hill, 18.3.12, G. Garrow."

In this species the scutum is considerably wider than long, with A–P relatively short, SB posterior of line of PL, and the posterior margin deep behind PL and considerably rounded. The eyes are only one on each side, the posterior eyes apparently being completely obsolete. The chelicerae are simple, with only the apical tricuspid cap, and the galeal setae are slender and nude. The palpi are fairly stout with trifurcate tibial claw; all the setae on femur, genu and tibia nude. The dorsal setae are 22 in number, arranged 2.8.6.4.2, to 50μ long, and fairly stout with short ciliations or serrations. All coxae unisetose. Tarsi III with one long nude seta.

The Standard Data given by Dumbleton for the type and paratype are: AW 81·0, 82·0, PW 99·0, 91·0, SB 40·0, 36·0, ASB 26·0, 30·0, PSB 20·0, 20·0, SD 46·0, 50·0, A–P 16·0, 16·0, AM —, —, AL 23·0, 26·0, PL 49·0, 49·0, Sens. 69·0, —.

For the additional specimens from Big Mill which I have seen and measured, the Standard Data are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	79·25±1·16	3·28±0·82	69·4–89·1	73·0–82·0	4·1
PW	90·75±1·74	4·92±1·23	76·0–105·5	82·0–99·0	5·4
SB	33·4±1·99	5·63±1·41	15·5–50·3	25·0–40·0	16·8
ASB	25·0±0·76	2·14±0·53	18·6–31·4	24·0–30·0	8·5
PSB	20·9±0·35	0·99±0·25	17·9–23·8	20·0–23·0	4·7
SD	45·9±0·66	1·88±0·47	40·1–51·5	44·0–50·0	4·1
A–P	17·5±0·33	0·92±0·23	14·7–20·3	16·0–18·0	5·3
AM	39·0±1·34	3·28±0·95	29·2–48·8	33·0–42·0	8·4
AL	27·6±1·02	2·87±0·72	19·0–36·2	23·0–32·0	10·4
PL	47·1±1·02	2·90±0·72	38·4–55·8	42·0–51·0	6·2
Sens.	74·0±1·00	2·45±0·71	66·7–81·3	69·0–75·0	3·3

TROMBICULA CERVULICOLA Ewing 1931.

Ewing 1931, Proc. U.S.N. Mus., 80, (8), 13, pl. I, fig. 3.

Plate 22, fig. K.

Ewing described this species very inadequately and illustrated the scutum by a somewhat inaccurate drawing. It was described from specimens from a deer, *Cervulus aureus*, from Muktesar, Kumaon, India.

Dr. G. W. Wharton some time ago re-examined the types in the U.S.N. Mus., and informed me in correspondence that the dorsal setae were not 26 in number, as stated by Ewing, but 38, arranged 2.8.8.8.6.4.2, and also that the lateral and ventral setae on the palpal tibia were nude.

In 1947 on a visit to Washington I was privileged to also examine the type and two paratypes of this species, and can now give the following details.

The scutum is roughly rectangular as now figured, with the anterior margin lightly sinuous; lateral margins straight or slightly concave and not convex as shown by Ewing; posterior margin fairly deep behind PL and flattened medially, not as in Ewing's figure; sensillae with a few indistinct branches distally, and bases in front of line of PL. Eyes 2 + 2, small. Chelicerae with only an apical cap. Galeal setae nude. Palpi with trifurcate tibial claw; setae on palpal femur and genu branched; on tibia, lateral and dorsal nude, ventral branched. Dorsal setae 34 to 36, arranged ca. 2.8.8.8.6.4.2, and to 50μ long. Leg III with a long nude outstanding seta on tarsi.

The Standard Data of the above three specimens as measured by me in 1947 are: AW 65·2, 65·2, 72·0, PW 71·5, 68·5, 81·5, SB 26·0, 26·0, 32·6, ASB 23·4, 23·4, 23·4, PSB 23·4, 23·4, 23·4, SD 46·8, 46·8, 46·8, A–P 26·0, 26·0, 32·6, AM 39·1, 42·0, 45·6, AL 39·1, 39·1, 45·6, PL 42·5, 42·5, 65·2, Sens. 72·0, 65·0, 81·5.

TROMBICULA *cf.* DENSIPILIATA Walch 1923.

Kitasato Archiv. Exper. Med., 5, (3), 79, 1923; Womersley and Heaslip, Trans. Roy. Soc. S. Aust., 67, (1), 80, 1943; Sig Thor and Willmann, 1947, Das Tierreich, Lfg. 71b, 267.

Plate 23, fig. B–E.

This species was originally described by Walch from a single specimen which, although he does not specify the host, was probably from a rat, from Deli, Sumatra. The very inadequate data given by Walch was summarized by Womersley and Heaslip 1943 (*loc. cit.*) and the Standard Data estimated from Walch's figures.

To this species are now assigned the following specimens.

Two specimens taken in a log near the camp at Morotai, Halmahera, in the Celebes, 24 April, 1945, by Maj. R. N. McCulloch. Only one of these was suitable for measuring and gave the following Standard Data: AW 66·0, PW 73·0, SB 26·0, ASB 30·0, PSB 12·0, SD 42·0, A–P 30·0, AM 45·0, AL 45·0, PL 60·0, Sens. 45·0.

One specimen collected by Capt. L. J. Dumbleton from a rat on Nissan, Green Island, in the Solomons, 23 March, 1944, with the following Standard Data: AW 69·0, PW 75·0, SB 24·0, ASB 27·0, PSB 15·0, SD 42·0, A–P 27·0, AM 42·0, AL 45·0, PL 62·0, Sens. 50·0.

The above values generally are somewhat lower than those computed by Womersley and Heaslip from Walch's drawings. The DS number ca. 54, are

arranged 2.12.10.10.8.6.4.2, and measure up to 50μ long. Walch gives the DS as numbering 58.

The dorsal scutum is rectangular with the posterior margin almost rectilinear between PL (in the Nissan specimen it appears to be somewhat deeper behind PL, although the same distance from SB, and resembling that in *nissani* Dumbleton). The palpal claw is trifurcate, setae on palpal femur and genu branched; on tibia dorsal and lateral nude, ventral branched (all 3 nude apparently in specimen from Nissan). The chelicerae are furnished with only the apical tricuspid cap, and the galeal setae are furnished with a single branch (not nude as given by Walch).

The anterior eyes on each side are very large and conspicuous and both eyes are on distinct ocular shields.

In the posterior scutal margin and the nude ventral seta of the palpal tibia the specimen from Nissan resembles the species *T. nissani* Dumbleton, but the number and arrangement of DS are as in *densipiliata*.

TROMBICULA CORVI Hatori 1920.

Taiwan Igakai Zasshi, No. 209, Pt. II; Kawamura and Yamaguchi, 1921, Kitasato Archiv. Exper. Med., 4, 169; Sugimoto, 1936, J. Jap. Soc. Vet. Sci., 15, (1), 200–213 (in Japanese with English Summary); Womersley and Heaslip, 1943, Tr. Roy. Soc. S. Aust., 67, (1), 88.

Plate 23, fig. A.

This species was described from fowls from Formosa. Hatori's original paper has not been seen but Kawamura and Yamaguchi give the following details in the form of a table.

"Length 789·1μ, width 648·8μ. Shape almost quadrate. Colour orange red. Dorsal scutum approximately trapezoidal, anterior margin shorter than posterior; anterior and lateral margins rectilinear in comparison with posterior margin which is backwardly curved; length 37·0μ, width 87·0μ; line between postero-lateral seta 8μ behind pseudostigmal line. Sensillae in distal half quite nude, in proximal half with 7–8 strong short branches; 58·1μ long. Eyes 1 + 1, lens 17·4μ in diam. Total setae 108?, dorsally arranged 12.10.16.12.10.8, length 45μ. Palpal femur with 1 long branched seta; genu same; tibia all 3 nude; tarsi with 1 thick long branched, 2 rather thin long branched setae. Galeal setae nude. Tarsi III without any long nude seta. On birds".

From these details Womersley and Heaslip (1943) gave an approximate scale figure of the dorsal scutum.

No material referable to this species has been seen since the original description, but apparently it is a form that should be easily recognized by the sensillae being nude distally and ciliated basally.

TROMBICULA INSOLLI Philip and Traub 1950.

J. Parasitol., 1950, 36, (1), 32–33, fig. 2.

Plate 23, fig. F–H.

This species was one of two described by the authors from bats *Eonycteris spelaea,* from the Batu Caves, near Kuala Lumpur, Federated Malay States, March, 1948.

From the description and figures given in the original publication the following details will diagnose the species.

Colour pale. Length (engorged) 536μ, width 286μ. Scutum as figured with AM slightly in advance of AL and the anterior margin lightly sinuous; posterior margin almost rectilinear between PL; sensillae filamentous, ciliated on distal two-thirds and their bases much nearer to line of PL than to AL; surface finely punctate; size small. Eyes 2 + 2, relatively large, posterior the smaller. Chelicerae with only the apical tricuspid cap. Galeal setae nude. Palpi stout with trifurcate palpal claw; setae on femur, genu and tibia all nude. Dorsal setae shortly ciliated, variable, 2. 8–9. 8–10. 8. plus ca. 20, to 45μ long. Ventrally with paired branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 18 to 20 setae, slightly shorter than dorsal setae on tarsi III.

The Standard Data as given by the authors for the type and 2 paratypes are: AW 52, 48, 50, PW 69, 65, 65, SB 22, 23, 23, ASB ca. 48*, PSB 12, 11, 12, SD ca. 60*, A–P 36, 35, 35, AM 44, 46, 45, AL 42, 42, 42, PL 57, 64, 60, Sens. 68, —, 65.

TROMBICULA (TROMBICULA) FRITTSI Wharton 1945.

Trombicula frittsi Wharton 1945, J. Parasitol., 31, (4), 282.

Plate 23, fig. I–L.

Re-description of Larvae. A small species of ovoid shape. Length 235μ, width 173μ. Dorsal scutum small and pentagonal with the posterior margins thickened and sinuous, the apical angle with a series of internally radiating lines; angle of convexity of posterior margin = 2·78. Eyes 2 + 2, close to the postero-lateral angles, the posterior slightly the smaller. Chelicerae rather short, with only the apical tricuspid cap. Galeal setae long and nude. Palpi stout with trifurcate tibial claw; setae on femur 2–3 branched; on genu nude; on tibia, ventral branched, dorsal and lateral nude; tarsi small with sub-basal sensory rod, 4 nude setae and 2 strongly ciliated setae over-reaching tip of claw. Dorsal

* Interpolated from Philip and Traub's figure.

setae 22, arranged 2.6.6.4.2.2, to 30μ long, and ciliated. Ventrally with a pair of branched setae on palpal segment I, one on each coxa, a pair between coxae I and between coxae III, and thereafter 4.4.2.2. setae to 20μ long. Legs: I 180μ long, II 162μ, III 180μ; tarsi I and II with the usual dorsal rod, III without any long nude seta. Sensillae rather thick-stemmed basally, with 5–6 branches distally.

The Standard Data for five specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	42·6±1·75	3·91±1·24	30·9–54·3	39·0–42·0	9·2
PW	54·0±1·48	3·31±1·05	40·05–63·95	51·0–58·0	6·1
SB	15·6±0·60	1·34±0·42	11·6–19·6	15·0–18·0	8·6
ASB	16·2±0·73	1·64±0·52	11·3–21·1	15·0–18·0	10·1
PSB	19·4±0·58	1·31±0·41	15·5–23·3	18·0–21·0	6·7
SD	35·6±1·25	2·79±0·88	27·2–44·0	33·0–39·0	7·8
A–P	17·6±0·40	0·89±0·28	14·9–20·3	16·0–18·0	5·1
AM	19·8±1·20	2·68±0·85	11·8–27·8	18·0–24·0	13·5
AL	18·4±0·40	0·89±0·28	15·7–21·2	18·0–20·0	4·8
PL	29·0±0·63	1·41±0·45	24·8–33·2	27·0–30·0	4·8
Sens.	36·0	No variation recorded.			

Loc. and Hosts. The above re-description is from five specimens collected by Ph, M. i/c L. A. Posekany of the U.S. Navy from somewhere in the Pacific, probably the Solomon Islands, 1944. Wharton recorded it from *Gehyra oceanica, Varanus indicus* and *Rattus praetor,* all from Bougainville.

Also from a scorpion, *Heterometrus longimanus,* from Kukit Lagong Forest Reserve, Kepong, near Kuala Lumpur, Sept. 1949 (J.R.A. and K.L.C.), in numbers, and reared through to the nymphs by K.L.C. The Standard Data of this material, 4 of 5 larvae from scorpions, 21 Sept. 1949, and 7 of 10 larval pelts, from same hosts and date, are slightly higher than as quoted above for the five specimens from Bougainville and are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	47·6±3·8	1·25±0·27	43·8–51·4	44·8–50·4	2·6
PW	63·1±9·5	3·15±0·68	53·6–72·6	58·8–70·0	5·0
SB	17·4±3·8	1·29±0·28	13·6–21·2	15·4–19·6	7·4
ASB	20·1±5·1	1·69±0·36	15·0–25·2	16·8–22·4	8·4
PSB	22·4	No variation recorded.			
SD	42·5±5·1	1·69±0·36	37·4–47·6	39·2–44·8	4·0
A–P	17·3±3·4	1·14±0·25	13·9–20·7	16·8–19·6	6·5
AM	31·1±5·0	1·69±0·40	26·1–36·1	28·0–33·6	5·4
AL	25·75±6·6	2·21±0·47	19·15–32·35	22·4–30·8	8·5
PL	32·3±4·4	1·46±0·31	27·9–36·7	30·8–33·6	4·5
Sens.	50·4	No variation recorded.			

Remarks. In his description, Dr. Wharton states, "Tibia III (of legs) with a sensory seta", and figures such a rod-like seta in his fig. 1A. An examination of his paratype in the S.A. Museum, however, shows that such a unique feature is not present, and this is confirmed by the recent material from Malaya. Probably the ciliations of a normal seta were adpressed and so misled him.

The host distribution of this species from a gecko, goanna, and rats from Bougainville, and from scorpions in Malaya is remarkable, and is somewhat paralleled by that of *T. rara* which is also known from a pillmillipede as well as from rats and man.

TROMBICULA INCURVA sp. n.

Plate 24, fig. A–B.

Description of Larvae. Shape ovate. Length (engorged) 530μ, width 330μ. Scutum as figured with anterior margin almost straight, posterior margin evenly curved and deep behind PL, lateral margins concave towards PL. Sens. behind line of PL. Scutal setae rather short, with AL the shortest. Eyes ? Chelicerae with only the usual apical tricuspid cap. Galeal setae nude. Palpal claw trifurcate; seta on femur with 4–5 long branches; on genu with one long branch; on tibia apparently all 3 nude. Dorsal setae short and stiff, to 20μ long, arranged 2.6.6.4.6.4.2.2. Ventrally with a pair of branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 20–24 setae, to 15μ long. Legs: I 212μ, II 186μ, III 212μ; tarsi I and II with the usual dorsal sensory rod, III without any long nude seta.

Standard Data of the type and paratype are: AW 48·0, 54·0, PW 63·0, 75·0, SB 19·0, 23·0, ASB 21·0, 22·0, PSB 18·0, 18·0, SD 39·0, 40·0, A–P 19·0, 20·0, AM 20·0, 20·0, AL 16·0, 19·0, PL 24·0, 26·0, Sens. 45·0, —.

Loc. and Hosts. The type and 1 paratype from a gecko at Mt. Gillen, Alice Springs, N.T. of Australia, 29.10.42. (R.V.S.).

TROMBICULA VIETZI sp. n.

Plate 110, fig. A–D.

Description of larvae. Shape ovoid but with sides rather parallel. Length (engorged) 603μ, width 402μ. Scutum as figured, wider than long, with posterior margin rather shallow behind line of PL; sensillae missing, bases in line with PL; AM and AL equal, PL very slightly long, with strong ciliations. Eyes 2 + 2. Chelicerae with only the apical tricuspid cap. Galeal setae nude.

Palpi as figured, with trifurcate tibial claw; seta on femur strongly ciliated, on genu nude, on tibia, dorsal and lateral nude, ventral branched. Dorsal setae shortly ciliated, short to 40μ, ca. 30 in number and arranged 2.8.6.6.4.2.2. Ventrally with paired setae on maxillae, one on each coxae, a pair between coxae I and between coxae III, and thereafter ca. 26 in number. Legs: I 248μ, II 221μ, III 248μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

Standard Data rather variable in AW and PW, for the type and 4 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	50·9±1·99	4·45±1·41	37·6–64·2	46·9–56·95	8·7
PW	58·95±2·01	4·49±1·42	45·45–72·45	53·6–63·65	7·6
SB	19·8±0·31	0·69±0·22	17·7–21·9	18·55–20·1	3·5
ASB	20·1	No variation recorded.			
PSB	10·05	No variation recorded.			
SD	30·15	No variation recorded.			
A–P	20·1	No variation recorded.			
AM	26·8	No variation recorded.			
AL	26·8	No variation recorded.			
PL	30·15	No variation recorded.			
Sens.	Missing.				

Loc. and Host. The type and 4 paratypes from rat's ear from Jubbulpore, India, Jan., 1947 (S. L. Kalra).

Remarks. This species, despite the absence of the sensillae is probably a *Trombicula.* It is remarkable for the strongly ciliated seta on palpal femur, and the long nude seta on the genu.

In the key it will come close to *T. incurva* sp. n., in caption 61. It is dedicated to Dr. Karl Vietz, the noted Hydrachnologist.

TROMBICULA LEVERI sp. n.

Plate 24, fig. C–F.

Description of Larvae. Shape ovoid. Length (engorged) to 750μ, width to 510μ. Dorsal scutum as figured, anterior margin only slightly convex, posterior margins almost rectilinear between PL; sensillae bases midway between anterior and posterior scutal margins, sensillae missing; AM and AL with longer and more outstanding ciliations than PL. Eyes 2 + 2, on distinct ocular shields, large, and separated from PL by about the length of PW; posterior eyes the smaller. Chelicerae missing. Galeal setae nude. Palpi with trifurcate tibial claw; setae on palpal femur and genu with long branches; on tibia, dorsal seta nude, both lateral and ventral branched. Dorsal striations

rather wide apart. Dorsal setae pointed and finely ciliated, 38 in number, and arranged 2.8.6.6.6.6.4.2, to 60μ long. Ventrally with a pair of ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 8.8.8.8.6.6.6.4.2, to 40μ long. Legs: I 330μ long, II 300μ, III 330μ; tarsi III without any long nude seta.

The Standard Data for the type and two paratype specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	62·0±1·00	1·73±0·71	56·8–67·2	60·0–63·0	2·8
PW	78·3±2·02	3·51±1·43	67·8–88·8	75·0–82·0	4·5
SB	24·0	No variation recorded.			
ASB	24·0	No variation recorded.			
PSB	24·0	Only one determination.			
SD	48·0	Only one determination.			
A–P	38·3±1·20	2·08±0·85	32·1–44·5	36·0–40·0	5·4
AM	57·0	Only one determination.			
AL	35·0±1·00	1·73±0·71	29·8–40·2	33·0–36·0	5·0
PL	62·0±1·00	1·73±0·71	56·8–67·2	60·0–63·0	2·8
Sens.	Missing in all specimens.				

Loc. The type and 3 paratypes from a bat, *Emballonura* sp., Delciomo, Lakeba, Lau, Fiji, 7 Nov., 1945 (R. A. Lever).

Remarks. Owing to the loss of the sensillae in all four specimens, the species is placed tentatively in *Trombicula*. Another specimen from a bat (R.10299) from Bukit Lagong, Kepong, Kuala Lumpur, Malaya, 6 Mar., 1950 (J. R. Audy, Slide 13590) is this species. (Specimen damaged during study.)

TROMBICULA PIERCEI Ewing 1931.

Ewing 1931, Proc. U.S.N. Mus., 80, (8), 13, pl. I, fig. 4.

Plate 24, fig. G.

This species taken from a bat *Hipposideros diadema griseus* from Negros, Philippine Islands, was very inadequately described, and only the palp figured. Lt.-Col. C. B. Philip (in litt.) says, "In an effort to decide on Ewing's *T. piercei* from bats on Negros, P.I., we remounted the very damaged types, but I couldn't even include them in my key. Best we could say was that any Philippine Trombiculids with sensillary pores almost on the hind margins of the scutum and less than twice the diameter between them might be suspected as this species".

In 1947, on my visit to Washington I re-examined the type U.S.N.M., No. 1021, and now give the following details and figure of the scutum.

Scutum not much wider than long, with SB in front of PL but behind midline of scutum; posterior margin a shallow curve rather flattened medially; sensillae now missing but bases about twice their diameters apart. (Ewing says sensillae slender, very long and barbed on distal two-thirds.) The galeal setae are nude. Palpal claw trifurcate; all setae on palpal femur, genu and tibia nude. Dorsal setae long and slender to 56μ, 42 in number and arranged ca. 2.8.8.8.6.4.4.2. Tarsi of leg III without any long nude seta.

The Standard Data of the type as measured in 1947 were: AW 58·7, PW 81·5, SB 26·1, ASB 34·5, PSB 27·6, SD 62·1, A–P 41·5, AM 55·2, AL 34·5, PL 76·0, Sens. —.

Remarks. The relationship of this species can now be given as in the key. The above details should enable the species to be recognized, but it has not as yet been again detected amongst the large amount of Philippine material seen by me.

TROMBICULA SYLVESTRIS Audy and Traub 1950.

Trombicula sylvestris Audy and Traub 1950, Bull. Raffles Museum.

Plate 24, fig. H–K.

Re-description of Larvae. Shape broadly oval. Length (fully engorged), 780μ, width 610μ. Scutum as figured, somewhat quadrate, finely punctate, but with posterior margin sinuous and fairly deep behind PL; sensillae bases in line with PL; sensillae missing. Eyes ? Chelicerae simple, with only the apical tricuspid cap. Galeal setae branched. Palpi stout, with bifurcate tibial claw; setae on femur and genu nude, on tibia, dorsal branched, lateral and ventral nude. Dorsal setae 26 in number, arranged 2.8.6.6.4, from 87μ long anteriorly, to 70μ posteriorly, thick on basal half and then tapering (as are the scutal setae) and with adpressed ciliations. Ventrally with a pair of branched setae on maxillae, a long ciliated seta on each coxa, a pair between coxae I and between coxae III and thereafter ca. 8.6.4.4.4.2.2.2, to 42–60μ long. Legs: I 390μ long, II 375μ, III 430μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for three paratypes are:

AW	PW	SB	ASB	PSB	SD	A–P	AM	AL	PL	Sens.
72·8	92·4	36·4	44·8	22·4	67·2	44·8	72·8	50·4	89·6	—
72·8	92·4	36·4	44·8	22·4	67·2	44·8	—	56·0	89·6	—
78·4	98·0	42·0	47·6	19·6	67·2	47·6	75·6	56·0	89·6	—

Loc. Described by Audy and Traub from specimens on *Rattus sabanus* from Ulu Langat, Kuala Lumpur, Malaya, 5 Dec., 1949.

Remarks. The above re-description is from three paratypes sent by Dr. Audy and from the original description.

TROMBICULA GLIRICOLENS (Hirst 1915).

Microtrombidium gliricolens Hirst 1915, Bull. Ent. Research, 6.

Trombicula gliricolens Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 82.

Trombicula (*Eutrombicula*) *gliricolens* Sig Thor and Willmann, 1947, Das Tierreich, Lfg., 71b, 281.

Plate 25, fig. A–E.

This species does not appear to have been met with or recorded since its original discovery on a rat at Calcutta, India.

Through the kindness of Dr. J. R. Audy and Maj. S. L. Kalra, I have recently been able to study a number of specimens collected from rats, at Tithwal, N. Kashmir, by S. L. Kalra, 1945.

I believe that these specimens can be referred to Hirst's species, despite certain disagreements with the original dscription and figure, viz. (1) the palpal claws are definitely trifurcate, whereas Hirst says they are bifurcate, and (2) the posterior scutal margin is not a more or less even curve but distinctly concave medially. Both these characters may have been inaccurately observed. In all other respects, size of scutum, dorsal setae, setation of palpi, etc., these specimens agree with *gliricolens*.

A re-description of these larvae is as follows:

Larvae. Shape oval. Length (engorged) to 650μ, width to 420μ. Scutum as figured, more or less rectangular, with anterior margin lightly sinuous and convex medially; surface rather coarsely punctate; sensillae in line of PL; AM the shortest and well behind line of AL; PL the longest. Eyes 2 + 2, posterior the smaller. Palpi with trifurcate tibial claw; setae on palpal femur and genu branched or ciliated; on tibia ventral branched, dorsal and lateral nude. Chelicerae simple, with distinct apical tricuspid cap. Galeal setae branched. Dorsal setae tapering, shortly ciliated, 40 in number and arranged 2.10.8.8.6.4.2, to 45μ long. Ventrally with paired ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter

6.6.6.4.6.4.2, to 34μ long. Legs all 7-segmented, I 285μ long, II 260μ, III 300μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for eleven specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	70·5±0·51	1·69±0·36	65·4–75·6	67·2–72·8	2·4
PW	83·5±0·91	3·02±0·64	74·5–92·5	78·4–89·6	3·6
SB	25·5±0·25	0·84±0·18	23·0–28·0	25·2–28·0	3·3
ASB	28·3±0·25	0·84±0·18	25·8–30·8	28·0–30·8	3·0
PSB	13·6±0·27	0·90±0·19	10·9–16·3	11·2–14·0	6·6
SD	41·9±0·55	1·82±0·39	36·4–47·4	39·2–44·8	4·3
A–P	24·4±0·55	1·81±0·39	19·0–29·8	22·4–28·0	7·4
AM	33·2±1·11	3·15±0·79	23·8–42·7	30·8–39·2	9·5
AL	38·7±1·05	3·50±0·75	28·2–49·2	33·6–42·0	9·0
PL	51·2±0·55	1·81±0·39	45·8–56·6	50·4–56·0	3·5
Sens.	63·0	—	—	61·6–64·0	—

TROMBICULA PHILIPI sp. n.

Plate 25, fig. F–J.

Description of Larvae. Shape ovate. Size small; length 225μ, width 170μ. Dorsal scutum more or less rectangular, with PW greater than AW; anterior margin sinuous, being convex medially and concave laterally of the middle; posterior margin rather shallow and more or less evenly curved; SB nearer to posterior than to anterior margin; antero-lateral corners produced well in front of AL; AM nearer to line of SB, than to line of AL; just in front of AL is a transverse line extending right across scutum and just behind this is a pair of oval discs; surface of scutum strongly rugose; scutal setae with closely adpressed ciliations; sensillae with only 2–3 branches in distal half. Eyes 2 + 2, on distinct ocular shields, posterior eyes the smaller. Chelicerae with only the apical tricuspid cap. Galeal setae with 1 or 2 long branches. Palpi stout. tibial claw trifurcate; seta on femur with 2–3 long branches; on genu with 1–2; on tibia, dorsal and lateral nude, ventral with 4–5 branches; tarsi with the usual basal rod and 5–6 ciliated setae, one longer than the others and reaching beyond tip of claw. Dorsal seta 54, stiff and needle-like with only short inconspicuous adpressed ciliations, arranged ca. 2.10.8.10.12.6.4.2, to 22μ long. Ventrally with the usual pair of branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter about 60 setae, somewhat similar to the dorsal setae. Legs: I 270μ long, II 225μ, III 270μ; tarsi I and II with the usual dorsal rod; III without any long nude seta.

The Standard Data from 25 specimens are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	64·5±0·42	2·12±0·30	58·2–70·8	60·0–68·0	3·3
PW	79·5±0·73	3·64±0·51	68·6–90·4	72·0–85·0	4·5
SB	22·6±0·29	1·44±0·20	18·3–26·9	21·0–24·0	6·4
ASB	24·9±0·39	1·97±0·28	19·0–30·8	21·0–30·0	7·9
PSB	15·3±0·15	0·73±0·10	13·1–17·5	15·0–17·0	4·8
SD	40·2±0·41	2·08±0·29	34·0–46·4	36·0–45·0	5·0
A–P	23·6±0·28	1·38±0·19	19·5–27·7	21·0–27·0	6·0
AM	35·75±0·37	1·87±0·26	30·15–41·33	30·0–39·0	5·2
AL	27·8±0·40	1·99±0·28	21·9–33·7	24·0–30·0	7·1
PL	32·0±0·33	1·64±0·23	27·1–36·9	30·0–36·0	5·1
Sens.	55·3±1·29	3·87±0·91	43·7–66·9	50·0–60·0	7·0

Loc. and Host. Twenty-one specimens from *Hipposideros cervinus,* Hollandia, D.N.G., (C.B.P. 8), 13 Nov., 1945, and four specimens from the same host and locality (W. D. Fitzwater), (no date).

TROMBICULA QUADRIENSE Womersley and Heaslip 1943.

Tr. Roy. Soc. S. Austr., 67, (1), 79, 1943.

= *Trombicula chiroptera* Womersley and Heaslip 1943, *ibid,* 80.

Plate 25, fig. K–N.

A re-examination and re-measurement of the type and paratype of *Tr. chiroptera* now shows it to be conspecific with *quadriense* which has page priority.

This is a rather characteristic species in the form of the scutum in which the posterior margin is strongly crescentic and PW very much greater than AW so that the antero-lateral angles are strongly obtuse. The surface of the scutum appears strongly rugose. The eyes are 2 + 2, with the posterior the smaller. Chelicerae furnished only with the usual apical tricuspid cap. Galeal setae branched. The palpal claw is trifurcate; the setae on the palpal femur and genu, and ventrally on the tibia are branched. The dorsal setae are 28, arranged 2.8.6.6.4.2, to 40μ long. Ventrally all coxae are unisetose and posterior of coxae III the setae are 2.6.2.4.2, to 27μ long. Tarsi of leg III without any long nude seta. The Standard Data for the type and two paratypes of *quadriense* and the type and paratype of *chiroptera* are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	58·8±0·80	1·79±0·56	53·5–64·1	56·0–60·0	3·0
PW	83·8±0·73	1·64±0·52	78·9–88·7	82·0–85·0	1·9
SB	20·2±0·92	2·05±0·65	14·1–26·3	18·0–22·0	10·1
ASB	21·0	No variation recorded.			
PSB	16·75±1·46	2·93±1·03	8·0–25·5	15·0–21·0	17·5
SD	38·25±1·43	2·87±1·01	29·65–46·85	36·0–42·0	7·5
A–P	23·5±1·04	2·08±0·73	17·3–29·7	21·0–26·0	9·0
AM	30·75±0·75	1·50±0·53	26·25–35·25	30·0–33·0	4·9
AL	27·0	No variation recorded.			
PL	44·0±1·00	2·24±0·71	37·3–50·7	40·0–45·0	5·1
Sens.	50·0	Only one determination.			

Of recent material I have seen and examined a specimen from ? Solomons, 1944 (L. A. Posekany) and four specimens collected by R. N. McCulloch at Wongabel, Queensland, Feb., 1945, two each from a bandicoot and a possum. Unfortunately, these specimens have been lost or misplaced.

TROMBICULA PELTA sp. n.

Plate 26, fig. A–E.

Description of Larvae. Shape elongate oval. Size large, length (engorged) 965μ, width 680μ. Scutum small, rectangular, sparsely but distinctly punctate; anterior margin sinuate; posterior margin convex but concave medially; PL seta slightly the longer, AM seta about in line with AL; sensillae missing but bases behind line of PL. Eyes not visible. Chelicerae nonserrate, with only the apical tricuspid cap. Galeal setae ciliated. Palpal claw trifurcate, seta on palpal femur branched or ciliated; on genu nude; on tibia, dorsal and lateral nude, ventral branched; tarsi with dorsal and apical rods and 4 or 5 ciliated setae. Dorsal setae ciliated, short, to 28μ, arranged ca. 2.8.6.6.6.4.2. Ventrally with the usual pair of ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 6.6.6.6.6.4.2, to 32μ long. Legs: I 241μ long, II 210μ, III 255μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

Standard Data: AW 43·2, PW 53·2, SB 16·0, ASB 21·8, PSB 7·0, SD 28·8, A–P 16·0, AM 30·0, AL 28·8, PL 35·6, Sens. —.

Loc. and Host. The unique type from a rat, Nainital, Kumaon Hills, India, 10 Oct. 1946 (S. L. Kalra).

Remarks. May be separated as in the key.

TROMBICULA (NEOTROMBICULA) JAYEWICKREMEI sp. n.

Plate 26, fig. F–J.

Description of Larvae. Colour in life unknown. Shape ovoid. Length (engorged) to 450μ, width 350μ. Scutum rectangular; with posterior margin shallow behind line of PL, and concave medially; surface lightly punctate, AM and PL about equal; sensillae filamentous, ciliated distally, and their bases slightly in advance of PL. Eyes 2 + 2, on ocular shields, close to scutal borders, posterior eyes the smaller. Chelicerae with only the small apical tricuspid cap. Galeal setae branched or feathered. Palpi stout; claw trifurcate; setae on palpal femur and genu lightly branched, on tibia all setae nude, except ventral. Dorsal setae 30 in number, arranged 2.8.6.6.4.2.2, to 50μ long, tapering and ciliated. Ventrally, one seta on each coxa, a pair between coxae I and between coxae III, then 6.4.4.2.2, shorter than dorsal setae. Legs: I 227μ long, II 210μ, III 260μ; tarsi I and II with the usual dorsal sensory rod, III without any long nude seta. The Standard Data from the best preparation are: AW 67·2, PW 81·2, SB 28·0, ASB 25·2, PSB 11·2, SD 36·4, A–P 25·2, AM 50·4, AL 44·8, PL 50·4, Sens. 56·0.

Loc. and Host. Described from seven specimens, collected by Mr. S. H. Jayewickreme; 3 from ears of *Rattus rattus kandiyanus*, from Nalanda, Ceylon, Sept., 1944, and 4 from ears of the same host from Embilipitiya, Ceylon, Nov., 1944.

Remarks. The relationship of this larvae is best shown in the key. It has been reared to the nymph by Mr. Jayewickreme, as described in the Adult and Nymphal section of this paper.

TROMBICULA SOUTHCOTTI sp. n.

Plate 26, fig. K–L.

Description of Larvae. Shape broadly oval. Length engorged to 420μ, width to 340μ. Dorsal scutum as figured, coarsely rugose, anterior margin almost straight, lateral margins slightly convex but coming out prominently near PL, which are thus placed on a lateral projection, posterior margin crescentic except near PL, sensillae bases nearer to posterior than to anterior margin and in front of line of PL, normal setae fairly thick with short setules, sensillae with four or five fine branches distally. Eyes 2 + 2, the anterior very convex and prominent, posterior inconspicuous. Chelicerae non-serrate but with the usual apical tricuspid cap. Galeal setae with a few fine branches basally. Palpi stout but small, tibial claw trifurcate; all setae on palpal segments branched,

the dorsal and lateral on tibia indistinctly so. Dorsal setae thick with short setulations, to 30μ long, and arranged 2.8.6.6.4.2. Ventrally with a pair of fine branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 2.6.4.4.4.2, to 25μ long, and finer than dorsal setae. Legs: I 260μ long, II 225μ, III 270μ; tarsi I and II with dorsal rod-like seta, III with a long nude seta, ordinary leg setae only sparsely ciliated.

The Standard Data from the type and two paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	56·7±1·33	2·31±0·94	49·8–63·6	54·0–58·0	4·1
PW	78·0	No variation recorded.			
SB	18·0	No variation recorded.			
ASB	21·0	No variation recorded.			
PSB	18·0	No variation recorded.			
SD	39·0	No variation recorded.			
A–P	30·0	No variation recorded.			
AM	30·0	No variation recorded.			
AL	25·0±1·00	1·73±0·71	19·8–30·2	24·0–27·0	6·9
PL	36·0	No variation recorded.			
Sens.	50·0	Only one determination.			

TROMBICULA CUNEATA (Traub and Evans 1951).

Trombiculindus cuneatus Traub and Evans 1951, Annals Entom. Soc. Amer.

Plate 27, fig. A–D.

Shape engorged broadly oval. Length engorged 416μ, unengorged 280μ; width 260μ and 180μ respectively. Scutum as figured, with PL aciculate-foliate, with 5 or 6 longitudinal finely dentate carinae, and much nearer to AL than to the rounded postero-lateral corners; anterior and posterior margins almost straight; lateral margins slightly concave between AL and PL, then convex; AM and AL normal, ciliated, with AM the longer; sensillae filamentous, with a few short barbs on basal half and 3–4 short ciliations on each side distally; surface punctate. Eyes 2 + 2, posterior of PL, posterior the smaller. Chelicerae simple, with only a prominent apical tricuspid cap. Galeal setae ciliated. Palpal claw trifurcate; setae on femur and genu nude, on tibia dorsal seta with a few branches; ventral nude, lateral nude and short. Dorsal setae aciculate-foliate with 5–6 longitudinal finely dentate carinae, about a third as wide as long, ca. 30–32 in number and arranged ca. 2.8.6.6.4.4.2, those of the anterior rows to 75μ long by 26μ wide and equal, posterior two rows smaller.

Ventrally, with a pair of normal ciliated setae on maxillae, one such on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 8.6.2.2. Legs all 7-segmented, I 260μ long, II 234μ, III 286μ; tarsi I and II with dorsal sensory rod (spur), III without long nude seta.

The Standard Data for the type and 15 paratypes as given by Traub and Evans are:

AW	PW	SB	ASB	PSB	A–P	AM	AL	PL	Sens.
70±4	85±6	44±2	26±2	16±2	16±2	63±3	31±4	60±7	68±5

Loc. and Hosts. The type specimen was from *Crocidura* sp. from Myitkyima, N. Burma, 29 Nov., 1944 (coll. U.S.A. Typhus Commission), and twenty-five paratypes from *Crocidura* or *Suncus,* same locality, Nov., 1944 to Feb., 1945, or from *Crocidura* from Shingbwiyang, Burma, Feb., 1945.

Remarks. In 1947 I was able to measure the Standard Data of the type and 3 paratypes in the U.S. N. Mus., tentatively labelled as *Webberia carinofoliata g. et* sp. n. The data were as follows: AW 74·95±7·35, PW 88·5±23·7, SB 43·65±4·61, ASB 29·3, PSB 14·5±5·0, SD 43·8±5·0, A–P 15·3±2·1, AM 68·0, AL 31·9±11·0, PL 68·25±4·5, Sens. 75·0, which correspond with Traub and Evans' measurements.

The two species recorded by T. J. Lawrence in Appendix 7, in "Scrub-typhus Investigations in S.E. Asia", Part III, AMD 7, War Office, March, 1947, as from a shrew, *Suncus caeruleus fulvocinereus* Anderson, from Imphal, 1945, as "Gen. nov. species," "W" being decsribed in U.S.A., are the above species.

The Standard Data for these two specimens are somewhat higher than for the type series, viz. AW 84·0, 84·0, PW 106·4, 112·0, SB 50·4, 50·4, ASB 33·6, 33·6, PSB 22·4, 22·4, SD 56·0, 56·0, A–P 16·8, 16·8, AM 75·0, —, AL 36·4, 36·4, PL 84·0 × 28·0, 84·0 × 28·0, Sens. —, —.

N.B.—In the figures given here, the dorsal seta on the palpal tibia are shown as nude, whereas actually they are lightly branched as in Traub and Evans' figures, and the AM and AL scutal setae are rather stouter than shown in the figures in this paper.

TROMBICULA SQUAMIFERA sp. n.

Plate 27, fig. E–I.

Description of Larvae. Shape oval. Length (partially engorged) 520μ, width 350μ. Scutum large, as figured, PL nearer to AL than to posterior margin; PL aciculate-foliate with longitudinal rows of setules; sensillae filamentous, in specimens broken short, the bases wide apart and behind line of PL; AM and

AL normal, strongly ciliated with AM the longer. Eyes 2 + 2, fairly large. Chelicerae with only the apical cap. Galeal setae strongly branched or ciliated. Palpi stout, tibial claw trifurcate; all setae on femur, genu and tibia (except dorsal) nude. Dorsal setae aciculate-foliate, the 6 of the second row narrower than others; 40 in number, and arranged 2.6.6.8.8.6.4, the anterior ones to 112μ long by 42μ wide, posteriorly not much smaller. Ventrally with a pair of long ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 30 setae to 70μ long followed by 6 and 4 setae similar to dorsal setae; on ventral surface laterally on each side between coxae II and coxae III is anothr aciculate-foliate seta. Legs all 7-segmented; I 390μ long, II 364μ, III 416μ; tarsi I and II with dorsal rod-like seta, III without any long nude seta.

The Standard Data for the type and paratype are: AW 95·2, 98·0, PW 117·6, 117·6, SB 47·6, 47·6, ASB 39·2, 39·2, PSB 28·0, 28·0, SD 67·2, 67·2, A–P 28·0, 28·0, AM 75·6, 72·8, AL 47·6, 53·2, PL 112·0 × 42·0, 106·8 × 42·0, Sens. broken short.

Loc. and Host. The type and paratype from a "mouse" from Baltal, Kashmir, India, 1945, Maj. S. L. Kalra.

Remarks. This species, in the form of the PL and dorsal setae is very close to *cuneata* but differs in the Standard Data, the number and arrangement of the dorsal setae and in the ventral setae, as given in the key.

TROMBICULA SQUAMOSA (Radford 1948).

Trombiculindus squamosus Radford 1948, Proc. Zool. Soc., London, 118, (1), 126–128, fig. 1–3.

Plate 28, fig. A–D.

This very interesting species was described by Radford from 20 specimens from the ears of a rat taken at Ranikhet, Nainital, in the Kumaon Hills, India, Oct. 1946 by S. L. Kalra. The type is in the British Museum collection.

The erection of a new genus for this species on the basis of the peculiar foliate or phyllode-like dorsal and posterior ventral setae is unnecessary. Such similar modification of the dorsal setae is of frequent occurrence in many genera of widely different families of Acari. For example, in the Cheyletidae, Tyroglyphidae, s.l., Oribatoidea, Tetranychidae, etc., and also in certain species of *Schöngastia* (*Ascoschöngastia*) (Trombiculidae) foliate setae are not uncommon.

I have been privileged to examine a paratype presented by Dr. Radford, and from his specimen I give the following re-description, as certain important details are omitted from the original description.

Re-description of Larvae. Shape broadly oval, fairly well chitinized. Colour in life probably red. Length (only partially engorged) 325μ, width 210μ. Dorsal scutum roughly rectangular, with fine pitting; anterior margin sinuous, posterior margin fairly shallow and slightly concave medially; AM and AL slender and strongly ciliated, AM well behind line of AL, PL broadly phyllode-like with strong punctures. Sensillae filamentous, basally with distinct barbs, distally ciliated, bases in line with or slightly behind PL. Eyes 2 + 2, on ocular shields, posterior the smaller. Chelicerae strong, not serrate, with only the usual apical tricuspid cap. Galeal setae strongly ciliated. Palpi stout, tibial claw trifurcate; all setae on femur, genu and tibia (except dorsal) nude. Dorsal setae all broadly phyllode-like, punctate and without ciliations, covering entire dorsal surface posterior of scutum, 32 in number and arranged 2.6.6.6.6.4.2, to ca. 60μ wide by 60μ long. Ventrally with a pair of ciliated setae on maxillae, one on each coxa, those on coxae II shorter than on I and III; a pair of similar setae between coxae I and between coxae III, and thereafter ca. 20 long ciliated setae arranged ca. 12·6 and 1 on each side of anus; the extreme lateral of first row are the longest, to 100μ; behind and flanking the anus are three rows of 6.6. and 2, phyllode-like setae similar to the dorsal, and laterally betewen coxae II and III also a phyllode seta. Legs all 7-segmented; I 312μ long, II 292μ, III 360μ; tarsi I and II with the usual dorsal sensory rod, III without any long nude seta.

The Standard Data for this specimen are as follows: AW 88·0, PW 100·0, SB 40·0, ASB 36·0, PSB 11·0, SD 47·0, A–P 31·0, AM 73·0, AL 67·0, PL 75·0 × 54·0, Sens. 80·0.

Remarks. Closely related to this species in having phyllode-like PL and dorsal setae are the following three species, *cuneata, squamifera* and *foliacea*, and all four can be readily separated as in the key. While all four form a group of species the erection of a genus or even subgenus on the group characters is, as stated above, unjustified, at least until such time as the nymphal or adult stages are known.

TROMBICULA FOLIACEA (Traub and Evans 1951).

Trombiculindus foliaceus Traub and Evans 1951. Annals Entom. Soc. Amer.

Plate 28, fig. E–I.

Shape engorged broadly oval. Length engorged 650μ, unengorged 430μ; width 520μ and 240μ respectively. Scutum subrectangular as figured, with PL phyllode-like with large reticulations and placed very much nearer to AL than to the rounded postero-lateral corners; anterior and posterior margins

almost straight, lateral margins lightly concave between AL and PL, then convex; AM and AL normal and ciliated with AM the longer; sensillae filamentous with rather short ciliations on distal half, their bases well behind line of PL; surface finely punctate. Eyes 2 + 2, posterior of PL, posterior the smaller. Chelicerae simple, with only a rather prominent apical tricuspid cap. Galeal setae ciliated. Palpi with trifurcate tibial claw; setae on femur and genu nude; on tibia dorsal seta branched, ventral and lateral nude, the ventral short. The dorsal setae are broadly phyllode-like with large reticulations and an acute apex, about half as wide as long, ca. 28 to 30 in number and arranged 2.8.6.6. 4.2.2., the posterior 2 rows somewhat smaller than the others. Ventrally with a pair of normal ciliated setae on maxillae, one such on each coxa, a pair between coxae I and between coxae III and thereafter ca. 16 to 20 normal ciliated setae. Legs all 7-segmented; tarsi I and II with dorsal sensory rod (spur), III without any long nude seta; leg I to 234μ long, II 221μ, III 286μ.

The Standard Data from the values given by Traub and Evans for the type and 6 paratypes treated statistically are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	66·3±0·64	1·70±0·45	61·2–71·4	63·0–68·0	2·5
PW	82·15±1·01	2·67±0·71	74·15–90·15	77·0–84·0	3·2
SB	38·9±0·77	2·04±0·54	32·8–45·0	35·0–42·0	5·2
ASB	26·3±0·57	1·50±0·57	2·18–30·8	25·0–28·0	4·2
PSB	14·6±0·37	0·97±0·26	11·7–17·5	14·0–16·0	6·7
SD	40·9±0·74	1·95±0·52	35·1–46·7	39·0–44·0	4·8
A–P	12·9±0·40	1·07±0·29	9·7–16·1	12·0–14·0	8·3
AM	50·7±1·20	2·08±0·85	44·5–56·9	49·0–53·0	4·1
AL	30·6±1·27	3·36±0·90	20·5–40·7	28·0–35·0	10·9
PL	65·9±1·72	4·56±1·22	52·2–79·6	60·0–73·0	7·0
Sens.	60·0	Only one determination.			

Loc. and Host. The type was recorded from a shrew *Crocidura* sp. from Shingbwiyang, Burma, 13 Feb., 1945, and the paratypes from the same host species and locality, Feb. and March, 1945, collected by members of the U.S.A. Typhus Commission.

A further specimen is that recorded by T. J. Lawrence in Appendix 7 in "Scrub-typhus Investigations in S.E. Asia", Part III; AMD 7, War Office, March, 1947. This specimen, from which the present drawings are given, was much more engorged than Traub and Evans' material. It was referred to as "Gen. nov., species Fols." "Lawrence in M.S." and was recorded from a shrew *Suncus caeruleus fulvocinereus* Anderson from Kanglatongbi, near Imphal, 1 Nov., 1945.

Remarks. In 1947 I was able to examine the type and 2 paratypes in the U. S. N. Mus., which at that time had been tentatively labelled as *Webberia cytofoliata* g. et sp. nov. by the discoverers. This name has been dropped and the species placed in Radfords *Trombiculindus* under the specific *cuneatus* nov.

As pointed out under *squamosa,* neither *Webberia* nor *Trombiculindus* are required, at least until the nymphs or adults are known and can be shown to exhibit good generic differences from *Trombicula.*

N.B.—In the figures given here, the dorsal seta on the palpal tibia are shown as nude, whereas actually they are lightly branched as in Traub and Evans' figures, and the AM and AL scutal setae are rather stouter than shown in the figures in this paper.

TROMBICULA (NEOTROMBICULA) HARRISONI sp. n.

Plate 29, fig. A–D.

Description of Larvae. Length (engorged) to 260μ, width to 195μ. Scutum roughly trapezoidal with AM and AL about in the same line; SB very close together and much closer to line of PL than to AL; posterior margin almost rectilinear between PL; PL the longest, AM and AL subequal; sensillae somewhat thickened medially, and then tapering, with ciliations for most of their length. Eyes 2 + 2. Chelicerae non-serrate. Galeal setae short and nude. Palpi as figured, femur outwardly rather angular, and seta branched; palpal claw trifurcate. Dorsal setae tapering, curved and shortly ciliated, to 36μ long, 32 in number and arranged 2.6.6.6.6.4.2. Ventrally with a pair of branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 40 setae to 30μ long. Legs all 7-segmented, I 260μ long, II 234μ, III 260μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data derived from ten specimens are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	47·9±0·31	0·93±0·22	45·1–50·7	47·6–50·4	1·9
PW	61·9±0·98	2·95±0·69	53·1–70·7	58·8–67·2	4·7
SB	19·6	No variation recorded.			
ASB	30·2±0·37	1·18±0·26	26·7–33·7	28·0–30·8	3·9
PSB	14·0	No variation recorded.			
SD	44·2±0·37	1·18±0·26	40·7–47·8	42·0–44·8	2·6
A–P	38·1±0·85	2·70±0·60	30·0–46·2	33·6–42·0	7·1
AM	41·1±0·59	1·44±0·42	36·8–45·4	39·2–42·0	3·5
AL	42·35±0·35	0·99±0·25	39·4–45·3	42·0–44·8	2·3
PL	47·6	No variation recorded.			
Sens.	68·6 Mean of two determinations 67·2 and 70·0.				

Loc. and Host. Described from the type and nine paratypes collected from bats, R.11018, from Bukit Lagong Forest Reserve, Kepong, Kuala Lumpur, F.M.S. (British Scrub-typhus Research Unit, Slide 14765 (6 spec.), 14766 (4 spec.), 1950).

Remarks. In the shape and general proportions of the scutum, this species is very close to *T. insolli* Philip and Traub 1950, also described from bats, from Malaya, and was at first thought to be this species. It differs from *insolli* however, slightly in the Standard Data, and more particularly in the form of the sensillae, in having all the setae on the femur, genu and tibia of the palpi branched, and in the fewer dorsal setae.

It is named after Mr. J. L. Harrison, ecologist to the S.T.R. Team.

The larvae were also reared through to the nymph (described elsewhere in this paper), by Mr. K. L. Cockings.

Genus TECOMATLANA Hoffmann 1947.

Annales Escuela Nacional de Ciencias Biologicas, 4, (4), 451–457, fig. 1–6
(Genotype *Tecomatlana sandovali* n. sp.)

= *Sauriscus* Lawrence 1949, Annals Natal Museum, 11, (3), 452, fig. 39 a–e
(Genotype *Sauriscus ewingi* n. sp.)

= *Trisetica* Traub and Evans 1950, J. Parasitol., 36, (4), 356–359, fig. 1–4
(Genotype *Trisetica melvini* n. sp.)

The genus *Tecomatlana* was based on a species from Mexican bats and characterized as follows:

"Palpal claw with four prongs, the middle one being much the largest. Chelicerae with a row of minute reflected teeth on the dorsal and apical region of the chela and with a single, obtuse, broad and little tooth on the ventral margin. Dorsal plate small, roughly pentagonal with only three setae in addition to the pseudostigmatic organs, which are flagelliform and filamentous. Eyes large in relation to other genera, the posterior ones being smaller. All tarsi with three more or less equal claws.

Differs from all other genera of the subfamily Trombiculinae in its dorsal plate, which bears only three setae, in addition to the pseudo-stigmatic organs and in the particular arrangement of the palpal claw".

Miss Hoffmann does not refer to the *postero-lateral scutal setae,* which are present, but due to the small and reduced scutum are not placed thereon, as is clearly shown in her figure 2. They are, however, the first row of 1 + 1 setae, in her series of dorsal rows. The description of "a row of minute

reflected teeth on the dorsal and apical region of the chela'' at first suggests a serrated chela. The author's figure 3 shows clearly, however, that the minute teeth are confined to the lower edge of the usual tricuspid cap, and are not the normal serrations on the inner cheliceral margin seen in some other Trombiculids.

The only valid character by which *Tecomatlana* can be generically separated appears to be the very much reduced scutum causing the postero-lateral setae to be widely situated off the scutum. Until such times as the nymphs or adults are known and correlated with the larvae the genus should perhaps stand on the above feature. It must be pointed out, however, that an indication of such displacement, although slight, is clearly seen in the Malayan species *Schöngastia* (*Ascoschöngastia*) *malayensis* Gater; and in *Schöngastia* (*Ascoschöngastia*) *masta* Traub and Sundermeyer 1950, the posterior lateral scutal setae are as far removed from the scutum as in *Tecomatlana,* etc.

The four-pronged palpal claw on which Miss Hoffmann lays stress is not of generic value, as is evidenced by the varied furcation of this organ, occurring within other genera, and as shown in the keys here given.

In 1949, R. F. Lawrence, overlooking *Tecomatlana,* described the genus *Sauriscus,* with similar scutal characters, for a species *Sauriscus ewingi* nov. from a gecko from S. Africa. The only character by which this might be generically distinct is the presence of but a single large eye on each side instead of two. The posterior eyes in many Trombiculids are frequently ill-defined, and difficult to see, so that one may be doubtful of the generic value of the number of eyes. Lawrence does not state the nature of the palpal claw.

More recently, Traub and Evans have described the genus *Trisetica,* for a species found inhabitating bat caves at Myitkyina, in Burma. They have apparently overlooked Lawrence's paper, and only compare their genus with *Tecomatlana.*

The scutum is similar to that of *Tecomatlana* and *Sauriscus,* being reduced with the postero-lateral setae well off the scutum. The palpal claws are contrasted with those of *Tecomatlana* in being trifurcate and somewhat long and straight. The apical tricuspid cap of the chelicerae lacks the minute teeth on its lower edge. The eyes are two on each side and large.

It appears then that both *Sauriscus* Lawrence, and *Trisetica* Traub and Evans are synonymous with *Tecomatlana* Hoffmann. Incidently, the somewhat thickened or ''subflagellate'' sensillae of the type of *Trisetica* approach the lanceolate form found in some species of *Schöngastia,* but its affinities are I believe nearer to *Tecomatlana* and *Trombicula* than to *Schöngastia.*

TECOMATLANA MELVINI (Traub and Evans 1950).

Trisetica melvini Traub and Evans 1950, J. Parasitol., 36, (4), 356–359, fig. 1–4.

Plate 29, fig. E–H.

Description of Larvae (after Traub and Evans). "Body subovate; dorsum and venter with fine parallel striations; length 0·54 mm.; width 0·38 mm.

Dorsal plate. Anterior margin slightly sinuate, concave at the insertion of the antero-lateral bristles, forming shoulders; lateral margins with a shallow median sinus; caudal margin very slightly concave, corners strongly rounded; punctate over most of its surface. Sensillae with short barbs on proximal portion, but apical two-thirds with longer cilia. Bases of sensillae inserted slightly posterior to midline of plate. Antero-lateral setae short and plumose. Antero-median bristle extending beyond apex of plate plumose. Postero-lateral setae as far off plate as bases of sensillae are from margin; near eyes; similar in shape and size to antero-median bristle. *Eyes*: Well-developed; anterior eye with diameter of 17 microns; that of posterior eye 10 microns. *Chelicerae*: Acuminate, about four times as long as broad near base; with a single subapical notch. *Palpal claw*: with lateral prongs almost as long as middle prong. *Palpal tarsus*: Longer than broad at base; with four ventral bristles, three of which are sparsely plumed and the fourth shorter and virtually unbarbed; with a proximal ventral short spur-like process; with a dorsal long bristle which is apically plumed. *Palpus*: Trochanter and femur each with a dorsal sparsely plumed bristle; tibia with a dorsal naked bristle and with a ventral short branched seta. *Galea*: With a pair of plumed proximal ventral setae. *Dorsal setae*: Similar in appearance to antero-laterals; about 52 in number; the rows irregular, but approximate arrangement of the anterior rows is: 2:12:12:10... *Coxae*: Punctate; unisetose, the setae plumose. *Sternal setae*: A pair of plumose setae between bases of coxae I and II; three such pairs between coxae III, the middle one of each group of three more posterior than the others. *Ventral setae*: Approximately 36 in number; short and irregularly arranged. *Legs*: I—0·27 mm.; II—0·23 mm.; III—0·25 mm. Sensory setae as follows: I—two genualae, one microgenuala, two tibialae, one microtibiala, one spur, one microspur laterad to spur, one pretarsala. I—one genuala, two tibialae, one spur, one microspur slightly proximad to spur, one pretarsala. III—one genuala, one tibiala. *Tarsal claws*: Elongate, acuminate, curved, resembling the blade of a scythe; middle claw slightly thinner than others."

The Standard Data given for four specimens by the authors show considerable variation as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	43·75±1·03	2·06±0·73	37·6–49·4	42·0–46·0	4·7
PW	66·75±5·22	10·44±3·69	35·45–98·05	56·0–81·0	15·7
SB	18·5±0·87	1·73±0·61	13·3–23·7	17·0–20·0	9·3
ASB	23·75±0·75	1·50±0·53	19·25–28·25	23·0–26·0	6·3
PSB	17·0	No variation recorded.			
SD	40·75±0·75	1·50±0·53	36·25–45·25	40·0–43·0	3·7
A–P	33·0±2·86	5·71±2·02	15·9–50·1	26·0–40·0	17·5
AM	36·7±1·76	3·05±1·24	27·5–45·9	34·0–40·0	8·3
AL	29·0±1·78	3·55±1·26	18·5–39·5	26·0–33·0	1·2
PL	43·75±0·75	1·50±0·53	39·25–48·25	43·0–46·0	3·4
Sens.	53·75±1·43	2·87±1·01	45·15–62·35	50·0–56·0	5·3

Genus MYOTROMBICULA Womersley and Heaslip 1943.

Trans. Roy. Soc. S. Austr., 1943, 67, (1), 99.

This genus erected for a specimen found amongst the debris in a jar of spirit containing bats in the collections of the South Australian Museum, the probable locality for the bats being South Australia. It was assumed that the specimen came off the bats.

The genus is peculiar in that the chelicerae are short and stumpy with two large blunt teeth, apparently an adaption for grasping hair. The palpi are also of peculiar structure, both the femur and genu being strongly and outwardly angulate. The tibial claw of the palp is not furcate, but on the outer edge is provided with two small teeth. The dorsal scutum is rectangular, provided with the normal five setae and two ? filamentous sensillae. The legs are all 7-segmented.

Genotype *Myotrombicula vespertilionis* Wom. and Heasp. 1943.

MYOTROMBICULA VESPERTILIONIS Wom. and Heasp. 1943.

Trans. Roy. Soc. S. Austr., 1943, 67, (1), 99.

Plate 30, fig. A–F.

Shape almost round. Length 275μ, width 280μ. Dorsal scutum transversely rectangular (cf. fig. A) with anterior margin concave, posterior evenly convex, and SB in front of line of PL; sensillae wanting, probably filamentous. Eyes apparently absent. Chelicerae short and stumpy with two blunt and strong teeth, as though for grasping hair (cf. fig. C). Galeal setae branched on distal fifth. Palpi stout, strongly incurved and both femur and genu outwardly strongly angulate; tibial claw not furcate but with two small teeth on outer margin; setae on femur and genu strong, curved, with short indistinct ciliations; on the tibia, the dorsal seta is similar, the lateral apparently nude and the ventral with many long branches; the tarsus is short, with sub-basal

sensory seta, subapical sensory nude seta, and 4 or 5 ciliated setae. Dorsal setae 2.6(8).8(6).8.4.8.6.4.2, to 23μ long, tapering with short ciliations. Ventral with paired branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter 2.4.4.6.6.4.2. Legs: all 7-segmented, I 170μ, II 145μ, III 145μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for the unique type are: AW 62·5, PW 65·5, SB 24·0, ASB 16·0, PSB 11·0, SD 27·0, A–P 16·0, AM 23·0, AL 19·0, PL 27·0, Sens. —.

Remarks. The modifications of the chelicerae and palpi suggest their adaption for grasping hair, although the modifications are not as pronounced as in the other pilicolous families Myobiidae and Listrophoridae.

Genus HEASLIPIA Ewing 1944.

Heaslipia Ewing 1944, Proc. Biol. Soc., Washington, 57, 101–104, *nom. nov.* for *Trombiculoides* Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 101, preoc. Jacot 1938, Psyche, 45, (2–3), 122.

As *Trombiculoides* Wom. and Heasp. 1943 with *Trombiculoides gateri* Wom. and Heasp. 1943 as genotype was preoccupied by *Trombiculoides* Jacot 1938 with Say's American *Trombidium scabram* as genotype, the name *Heaslipia* was proposed by Ewing (*loc. cit.*) in its place.

The genus is closely related to *Trombicula* s. str. in having only a single and anterior dorsal scutum with long filamentous sensillae, but differs in the characteristic scutum which has the lateral and posterior margins forming a continuous even curve, and is furnished with 9 setae in addition to the sensillae, arranged 1 AM, 2 AL and 2 PL with two extra ones on each side between the AL and PL setae. The chelicerae are also characteristic with a very large and pronounced inner subapical tooth in addition to the small apical tricuspid cap. The legs are all 7-segmented.

HEASLIPIA GATERI (Womersley and Heaslip 1943).

Trombiculoides gateri Wom. and Heasp. 1943, Tr. Roy. Soc. S. Austr., 67, (1), 101.

Heaslipia gateri, Ewing 1944, Proc. Biol. Soc. Washington, 57, 101–104; Lawrence 1949, Annals Natal Museum, XI, (3), 467.

Plate 30, fig. G–L.

In addition to the details given in the original description of the larval species, the seta on the palpal femur is 5-branched, on the genu 2–3 branched,

and on the tibia, the dorsal and lateral setae are nude, the ventral branched; the palpal tarsus is short and conical with sub-basal sensory rod and sub-apical nude sensory spine, and 5 or 6 ciliated setae. All legs are 7-segmented; tarsi I and II rather short with the usual dorsal sensory rod, and tarsi III is furnished with a long nude outstanding seta. The palpal claw is bifurcate.

Since the original description the dorsal scutum of the type and 2 paratypes have become more flattened and consequently the Standard Data are now somewhat greater.

The Standard Data as now re-determined for these specimens, together with one specimen from the Philippines are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	88·75±1·70	3·40±1·20	78·55–98·95	86·0–93·0	3·8
AW^1	107·0±1·00	2·00±0·71	101·0–113·0	104·0–108·0	1·9
AW^2	97·0±0·82	1·63±0·58	92·1–101·9	95·0–99·8	1·7
PW	74·25±1·44	2·87±1·01	65·65–82·85	72·0–78·0	3·8
MAX. W.	116·5±0·87	1·73±0·61	111·3–121·7	115·0–118·0	1·5
SB	33·0±1·00	2·00±0·71	27·0–39·0	32·0–36·0	6·0
ASB	29·0	No variation recorded.			
PSB	39·25±0·25	0·50±0·18	37·75–40·75	39·0–40·0	1·3
SD	68·25±0·25	0·50±0·18	66·75–69·75	68·0–69·0	0·7
$AL–AL^1$	14·50±0·50	1·00±0·35	11·5–17·5	14·0–16·0	7·0
$AL^1–AL^2$	18·25±0·63	1·26±0·44	14·5–22·0	17·0–20·0	6·9
$AL^2–PL$	21·0	No variation recorded.			
AM	67·7±1·26	1·52±0·89	60·2–75·2	65·0–70·0	3·7
AL	51·0±1·00	2·00±0·71	45·0–57·0	50·0–54·0	3·9
AL^1	92·0±1·15	2·31±0·82	85·1–98·9	90·0–94·0	2·5
AL^2	72·25±1·03	2·06±0·73	66·05–78·45	70·0–75·0	2·8
PL	58·25±1·70	3·40±1·20	48·05–68·45	54·0–61·0	5·8
Sens.	93·0±1·12	2·24±0·79	86·0–99·7	90·0–95·0	2·4

The additional measurements of the Standard Data as used above are:

AW^1 = distance between setae AL, i.e. the second pair of lateral setae.
AW^2 = distance between the third pair of lateral setae, i.e. AL.
Max. W. = maximum width of scutum.
$AL–AL^1$ = distance between first and second lateral setae.
$AL^1–AL^2$ = distance between second and third lateral setae.
$AL^2–PL$ = distance between third lateral and postero-lateral setae.
AL^1 and AL^2 = lengths of second and third pairs of lateral setae respectively.

Remarks. As the nymphal or adult stages of this species are unknown, its generic relationship with *Trombicula* s. str. is uncertain, but on the peculiar dorsal scutum and chelicerae in the larvae, a separate genus seems at present advisable.

This species, the genotype, was described from specimens from *Rattus rattus argentiventer* Chase, from Selinsing-Gunong, Semanggel, Perak, 15 March 1932, and sent to the Adelaide Museum for study from the Institute for Medical Research, Kuala Lumpur, F.M.S.

Lt.-Col. Philip's specimen was from the ear of a rat, at San Jose, Mindoro, Philippine Island (coll. J. R. Mangrum, Jan., 1945).

Genus NOVOTROMBICULA Womersley and Kohls 1947.

Tr. Roy. Soc. S. Austr., 1947, 71, (1), 4.

Larvae as in *Trombicula,* but with the dorsal scutum produced posteriorly, tongue-like, and taking in some of the median setae of some of the dorsal rows, as in the genus *Gahrliepia,* otherwise with the usual 5 setae and a pair of filamentous sensillae.

Genotype *Novotrombicula owiensis* Wom. and Kohls 1947.

NOVOTROMBICULA OWIENSIS Wom. and Kohls. 1947.

Tr. Roy. Soc. S. Austr., 1947, 71, (1), 4.

Plate 31, fig. A–H.

Shape subrotund. Size small; length (unfed) 255μ, width 180μ. Dorsal scutum large, tongue-shaped and produced posteriorly to take in the two median setae of the third dorsal row, in addition to the AM, AL and PL setae; sensillae long and filamentous with ciliations on the distal half, bases wide apart and about midway between line of AL and PL. Eyes 2 + 2, on distinct ocular shields placed close to the lateral scutal margin; posterior eyes the smaller. Chelicerae with only the usual apical tricuspid cap, but on the inner margin below the cap with rather prominent subapical angle. Galeal setae long and nude. Palpi rather slender, with rather long slender and bifurcate tibial claw, the dorsal prong of which is small and indistinct; palpal femur and genu with a long slender, shortly ciliated seta; all three setae on tibia long and apparently nude; tarsi moderately long and conical, with a long sub-basal sensory rod and five or six long ciliated setae. Dorsal setae rather thick, slightly tapering, shortly ciliated and of two sizes, arranged 2.4.4[2].4.2.2; the second row with the median pair just off the scutum and to 57μ long; the inner members of the third row are on the scutum and are short to 24μ. Ventrally with a pair of branched or ciliated setae on the gnathosoma, one on each coxa, a pair between coxae I and between coxae III and thereafter 6.2.2.2.2. to 24μ long. All three pairs of coxae touching. Legs: I 255μ long, II 240μ, III 275μ; tarsi I and II with the usual sensory rod-like seta, III without any long nude seta.

Genus SCHOENGASTIA Oudemans 1910.

Entom. Ber., 3, (54), 96, 1910.

Larval Trombiculidae, with a single anterior dorsal scutum furnished with 5 normal ciliated setae and a pair of clavate or capitate sensillae which arise from cupules inserted flat on the scutal surface and not in a transverse crest-like wall. Chelicerae not unusually slender, with the inner (dorsal) edge serrated or not. Palpal claw bifurcate or trifurcate. All legs 7-segmented, except in *S.* (*S.*) *oudemansi* (Walch), *S.* (*A.*) *heaslipi* Wom. and Heasp., and *S.* (*A.*) *traubi* sp. n., where leg II and III are 6-segmented.

Genotype *Thrombidium vandersandei* Ouds., 1905, Entom. Ber., 1, (22), 216.

The chelicerae in the genotype are serrated and this led the American authority, Dr. H. E. Ewing, to erect the genus *Ascoschöngastia* Ewing 1946 for those species, earlier placed in *Neoschöngastia* Ewing 1929, which had the chelicerae non-serrate and at the same time were without the transverse scutal crest of *Neoschöngastia*. As stressed in the section of this paper dealing with the adults and nymphs, species of *Schöngastia* and *Ascoschöngastia* in which those stages are known cannot be separated generically. In this regard it would appear to be unwise to treat *Ascoschöngastia* as more than a subgenus of *Schöngastia* on the basis of larval characters only. Similarly, although unknown as yet from the adult or nymphal stages, the genera *Euschöngastia* Ewing 1938, *Oenoschöngastia* Womersley and Kohls 1947 and *Radfordiana* nov. may ultimately be shown to be no more than of subgeneric status.

CHELICERAE SERRATED ON INNER (DORSAL) MARGIN.

Subgenus SCHOENGASTIA s. str. Ewing 1946.

1. LEGS I 7-SEGMENTED, II AND III 6-SEGMENTED.

SCHÖNGASTIA (SCHÖNGASTIA) OUDEMANSI (Walch 1923).

Trombicula oudemansi Walch 1923, Kitasato Archiv. Exper. Med., 5, (3); Fletcher, Lesslar and Lewthwaite, 1928, Tr. Roy. Soc. Trop. Med. and Hygiene, 22, 161.

Schöngastia oudemansi, Gater 1932, Parasitol., 24, 154; Womersley and Heaslip, 1943, Tr. Roy. Soc. S. Austr., 67, (2), 102.

Neoschöngastia impar Gunther 1939, Proc. Linn. Soc. N.S. Wales, 64, (1–2), 85; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 116; Radford 1942, Parasitol., 34, (1), 74.

Neoschöngastia bodensis Gunther 1940, Proc. Linn. Soc. N.S. Wales, 65, (5–6), 482.

Plate 32, fig. A–E.

In 1943 Womersley and Heaslip synonymized Gunther's *bodensis* from Borneo with his *impar* from New Guinea. The latter species, while agreeing with *oudemansi* of Walch in the form of the dorsal scutum, the dorsal setae and the lengths of the scutal setae, was considered to differ in the chelicerae not being serrated. On the last character it was placed in the genus *Neoschöngastia* as then understood, but in view of Ewing's restriction of this genus, *impar* would now become a species of *Ascoschöngastia* if the non-serration of the chelicerae did occur in this species.

In correspondence, however, Dr. H. S. Fuller has drawn my attention to the fact that in certain specimens determined by me as *impar* Gunther, in the collections of the British Museum (Nat. Hist.) careful examination shows that the chelicerae are indeed serrated. This observation, which I was able to affirm while in London in 1947, led me to re-examine all the material in the South Australian Museum collections of both *impar* Gunther and *bodensis* Gunther and to compare them with specimens of *oudemansi* Walch, from the Federated Malay States, determined by B. A. Gater.

In all this material it can now be stated that the chelicerae are definitely serrated and both of Gunther's species must be synonymized with *oudemansi* Walch. Amongst the species of *Schöngastia* from the Asiatic-Pacific region, *oudemansi* is particularly characterized, as in the key, by the almost rectangular scutum, furnished with comparatively short setae of which PL are the shortest. The sensillae are clavate, finely ciliated and the sensillae bases midway between the anterior and posterior scutal borders with a well defined inwardly curved line in front of each base. The palpal claw is bifurcate, and only the setae on the palpal femur and genu shortly and sparsely branched, almost nude. The dorsal setae are short, and arranged 2.6.6.6.6.4. Tarsi III are without any long outstanding nude seta. (In his description of *impar* (*loc. cit.* p. 86) Gunther states that tarsi III bear a long nude seta, but in the four paratypes I have been able to examine this is not so).

A remarkable feature of *oudemansi* (also of *impar* and *bodensis*) is that the femora of legs II and III are not secondarily divided as is that of leg I, and

as are all three pairs of femora in all other species of *Schöngastia,* except *S.* (*A.*) *heaslipi* Wom. and Heasp. and *S.* (*A.*) *traubi* sp. n.

The secondary subdivision of the femora however, is not a true articulation, and it seems unwise, at present, in view of our little knowledge of generic characters of the adult Trombiculidae to regard the non-subdivision of the femora of legs II and III of larvae of the above species as of more than subgeneric value.

The following Standard Data is derived from 1 specimen from Federated Malay States, det. as *oudemansi* by Gater, 4 paratypes of *impar* Gunther from Bulolo, N.G., 1 paratype of *bodensis* Gunther from Borneo, as well as 19 specimens from Lae, N.G. and Sansapore, D.N.G., previously identified as *impar.*

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	51·4±0·65	3·27±0·46	41·6–61·2	48·0–57·6	6·3
PW	66·1±0·47	2·34±0·33	59·1–73·1	64·0–73·6	3·5
SB	30·65±0·37	1·85±0·26	25·1–36·2	28·8–35·2	6·0
ASB	25·6		No variation recorded.		
PSB	19·45±0·15	0·74±0·10	17·25±21·65	19·2–22·4	3·8
SD	45·2±0·19	0·94±0·13	42·4–48·0	44·8–48·0	2·1
A–P	34·0±0·15	0·73±0·10	31·8–36·2	32·0–36·8	2·2
AM	34·7±0·33	1·20±0·23	31·1–38·3	32·0–35·2	3·5
AL	22·65±0·25	1·25±0·18	18·9–26·4	19·2–25·6	5·5
PL	13·55±0·22	1·12±0·16	10·2–16·9	12·8–16·0	8·4
Sens.	38·0 with head 9·6 wide. Only 1 determination.				

SCHÖNGASTIA (SCHÖNGASTIA) LEWTHWAITEI sp. n.

Ascoschöngastia n. sp. 'C', Lawrence, T. J., 1945. W. O. Rept., A.M.D.7, Appendix 7.

Plate 111, fig. A–C.

Description of Larvae. Shape (engorged) oval; length to 536μ, width to 375μ. Scutum as figured, sub-quadrate but wider than long, and with PW greater than AW; anterior margin lightly sinuous, posterior margin not very deep behind line of PL and lightly concave medially; sensillae bases large within strongly marked crescents, and much nearer to PL than to AL; sensillae unknown; AM, AL and PL setae subequal with AM slightly shorter than AL, and PL slightly shorter than AL. Eyes 2 + 2, posterior the smaller. Chelicerae with apical tricuspid cap and the inner edge finely but indistinctly serrate. Galeal setae nude. Palpi as figured, tibial claw bifurcate; setae on femur ciliated, on genu ciliated, on tibia ventral branched, dorsal and lateral apparenty nude. Dorsal setae ca. 42 in number to 45μ long and arranged 2.6.6.6.6.6.4.4.2. Ventrally with paired ciliated setae on maxillae, one on each

coxa, a pair between coxae I and between coxae III and thereafter ca. 46 to 30μ long. Legs: I 268μ long, II 241μ, III 308μ; I 7-segmented, II and III 6-segmented; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data derived from the type and 3 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff of Variation
AW	68·0±0·80	1·60±0·50	63·2–72·8	67·8–70·4	2·3
PW	86·0±3·09	6·18±2·18	67·5–104·6	80·0–92·8	7·2
SB	38·4		No variation recorded.		
ASB	35·2±1·31	2·61±0·92	27·4–43·0	32·0–38·4	7·8
PSB	22·4		No variation recorded.		
SD	57·6±1·31	2·61±0·92	49·8–65·4	54·4–60·8	4·5
A–P	44·8±1·31	2·61±0·92	37·0–52·6	41·6–48·0	5·8
AM	34·4±0·80	1·60±0·56	29·6–39·2	32·0–35·2	4·1
AL	35·2		No variation recorded.		
PL	36·0±0·80	1·60±0·56	31·2–40·8	35·2–38·4	4·4
Sens.		Missing.			

Loc. and Host. Amongst the material in Lawrence's "Type Box" of slides, in the London School of Tropical Hygiene and Medicine, which I have been permitted to study by Dr. J. R. Audy, are 4 slides, Nos. 37–40, labelled "*Ascoschöngastia* n. sp. 'C', Lawrence in M.S." and referred to as such in Appendix 7, to War Office Report, AMD 7, March, 1947.

Lawrence records these specimens as 3 from the type host, a tree shrew, *Tupaia belangeri belangeri* Wagner, and 2 specimens only from *Hydromys humei*. The locality was Palel, Tamu Rd., 30 miles south of Imphal, Manipur State, India, Nov. 24th, 1945.

Slides Nos. 39 and 40 are now in the collection of the South Australian Museum.

Remarks. This species in the conformation of the scutum closely resembles *S.* (*A.*) *lacunosa* Gater and was at first thought to be that species. In having the second and third pairs of legs, however, only 6-segmented and the inner margin of the chelicerae finely serrate it comes much closer to *S.* (*S.*) *oudemansi*, from which it differs in the Standard Data, especially the length of the PL scutal setae.

2. ALL LEGS 7-SEGMENTED.

a. *Palpal claw bifurcate.*

SCHÖNGASTIA (SCHÖNGASTIA) VANDERSANDEI (Ouds, 1905).

Thrombidium vandersandei Ouds. 1905, Entom. Ber., 1, (22), 216; 1909 Tijdschr. Entom., 52, 50.

Allothrombidium vandersandei Ouds. 1906, Entom. Berl., 2, (28), 56–59.

Thrombidium van der Sandei Ouds. 1906, Nova Guinea, 5, 106, 131, tab. 4, fig. 59–66; 1908, Tijdschr. Entom., 51, 25.

Microthrombidium vandersandei Ouds. 1912, Zool. Jahrb., Suppl. 14, 45–62.

Plate 32, fig. F–J.

This species was originally described by Oudemans from specimens found on man by Dr. G. A. J. van der Sande, Physician to the Dutch New Guinea Expedition of 1903.

In Nova Guinea, 5, Oudemans cites a large number of references to the presence of these mites, in New Guinea, Malay Archipelago and the Celebes. It is therefore remarkable that despite these leads, this species has not hitherto been recognized amongst the very large amount of material collected and studied during the war years. Most specimens have been referred by myself and other students to *Schöngastia blestowei* Gunther and other species. Gunther 1939 (Proc. Linn. Soc. N.S.W., 64, (1–2), 94) compared his species *blestowei* in detail with the data given by Oudemans for *vandersandei,* stressing particularly the facts that in *vandersandei* the palpal claw is bifurcate, in *blestowei* trifurcate, and that the dorsal setae are 50 and 64 respectively. In addition he states "maxillary setae plain" in *vandersandei,* "with 4 long branches" in *blestowei.* This difference, however, does not exist. In Oudemans' species, the maxillary seta is as figured by Oudemans (1906) branched and, as stated, "of the same kind as the other coxal hairs". The main differences between these two species then, as brought out in the key, are the furcation of the palpal claws and the number of dorsal and ventral setae.

The original description as given very fully in Nova Guinea 1906, is as follows: "*Larvae. Length* 200–300μ, measured on 40 specimens. *Colour* scarlet; in spirits colourless. *Shape* of newly-hatched larvae short, scarcely longer than wide, with small shoulders between legs I and II, and big rounded ones above legs III; abdomen posteriorly rounded. *Texture* of epistome, dorsal shield, palps and legs smooth, finely porate, of remainder skin of body finely wrinkled. These wrinkles run almost parallel to the transverse rows of dorsal hairs. *Dorsal side.* Dorsal *shield* subhexangular, with one anterior, one posterior and four lateral sides, wider than long; anterior side the longest and straight; the 5 remainder sides almost equal in length; posterior side slightly concave. *Eyes.* Aside of the shield a double eye, of which the anterior one is distinctly semi-globular, prominent and less light-refracting. *Pseudostigmata* almost in the centre of the shield, round, cup-shaped. *Pseudostigmatic organs* (sensillae) clavate; peduncle and head almost equal in length; peduncle rod-

like, thin, smooth; head swollen, distally rounded, proximally rapidly tapering towards the peduncle, seen from aside almost equal in width and length; seen on the top elliptical; yellowish brown with greenish hue; contents oily, very light refracting; surface of head examined under oil-immersion-system finely villous. *Hairs.* On the anterior margin of the shield one median hair. In each anterior and in each lateral corner of the shield a hair. On each shoulder above legs III a hair. On the abdomen 5 transverse rows of ten hairs each. All the hairs are slightly curved, except the above-mentioned median hair which is straight. The median hair scarcely hairy; the 4 other shield hairs are better haired; all the other dorsal hairs are more or less serrate.

Ventral side. Behind the rostrum there is a collar-shaped *shield,* widest in the centre. Coxae I triangular, with posterior external angle excavate to receive the "Urtrachee" which is round. Coxae II longer, internally rounded. Coxae III almost quadrangular; internally rounded. *Anus* ventral, nearer the posterior abdominal edge than the coxae III. *Hairs.* Coxal hairs thin, a little curved, beautifully pectinate with from three to five smaller hairs on the convex side. Between the proximal ends or angles of coxae I a pair of ditto. Between coxae III a pair of ditto. Behind this pair a single hair of stiff, slightly curved and externally serrate hairs resembling those of the dorsum. Further the whole venter is provided with hairs of the same kind, arranged in about four or five irregular transverse rows of about ten hairs each.

Epistome, pentangular, provided with a fine median line. *Mandibles* dorsally and internally slightly serrate.

Maxillae (palpi). Coxae with coxal hair close to the trochanterofemur, of the same kind as the other coxal hairs. Hypostome ventrally smooth, distally scarcely bilobate, dorsally opened, gutter-shaped and basally provided with long smooth hair.* *No trace of any epipharynx, nor of any hypopharynx.* Trochanterofemur dorsally and externally swollen, with proximal pectinate hair. Genu short with dorsal pectinate hair. Tibiotarsus dorsally with one smooth hair and one external pectinate hair, terminally with strong claw which externally and ventrally shows a smaller accessory claw almost in the middle. Telotarsus short, thick, club-shaped, ventrally with three pectinate hairs and two olfactoric hairs, dorsally with one pectinate hair and one olfactoric hair. *Legs* rather thick; their joints rather short, increasing in length distalward. Also the number of hairs with which they are ornated increased distalward, from one or two to about ten or twelve on each joint. The greater part of these hairs are pectinate. The following not pectinate hairs may be mentioned: *Legs I*: genu with short smooth hair; tibia with 3 short smooth hairs; tarsus with a thick, short, rod-like olfactoric hair and a long smooth tac-

*"Galeal seta" of recent authors.

tile hair, accompanied by a very short smooth olfactoric hair. *Legs II*: genu with one short smooth hair; tibia with one short smooth hair; tarsus with one short thick olfactoric hair. *Legs III*: genu with one short smooth hair; tibia with one short smooth hair. All the femora are distinctly divided in a *basifemur* and a *telofemur*. *Paratarsi* minute, almost invisible. Empodium claw-like, thin proximally and distally nodded. Claws rather strong, curved, thicker than claw-like empodium".

In the above description it is to be noted that the long nude outstanding seta present on tarsi III of all the specimens now referred to Oudemans species, is neither mentioned nor figured. This is remarkable considering the meticulous work of Dr. Oudemans, but this seta is however, when lying longitudinally along the tarsus sometimes difficult to see, and one must presume that Oudemans may have overlooked it.[1] Its closest relative amongst those species of *Schöngastia* s. str. with bifurcate palpal claws is *S. pseudo-schuffneri* (Walch), which is distinguished as in the key by the shape and dimensions of the dorsal scutum, and the number and arrangement of the dorsal setae.

The following Standard Data is derived from 63 specimens now recorded from various localities in New Guinea: Abidari, Mandated Territory, 28 July, 1943 (1 spec. R. N. McCulloch); Dumpu, M. T., Nov. 1943 (5 spec. R. N. McC.); Lae, M.T., 8 Aug. 1944 (6 spec. R.N.McC.); Buna, M.T. (2 spec. No. 32–1, 3 spec. No. 32–5, G. M. Kohls); Milne Bay, Papua, Aug. 1943 (5 spec. S. L. Allman), Nov. 1943 (5 spec. on *Rattus comatus*, W. D. Exton); Hollandia, D.N.G., 2 Mar. 1945 (2 spec. on boots, C. B. Philip), (3 spec. on man, C.B.P.), 22 May, 1945 (6 spec. on man, C.B.P.); Sansapore, D.N.G., 10 Nov. 1944 (5 spec. on *Rattus concolor*, C. Mohr.), 25 Nov. 1944 (3 spec. on *Rattus ringens*, 1 spec. on *R. concolor*, C.M.).

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	66·9±0·41	3·30±0·29	57·0–76·8	60·8–76·8	4·9
PW	88·6±0·57	4·54±0·40	75·0–102·3	80·0–99·2	5·1
SB	25·8±0·10	0·83±0·07	23·3–28·3	24·0–28·8	3·2
ASB	35·5±0·12	0·95±0·08	32·6–38·4	35·2–38·4	2·7
PSB	28·7±0·09	0·72±0·06	26·5–30·9	25·6–32·0	2·5
SD	64·1±0·15	1·17±0·10	60·6–67·6	60·8–67·2	1·8
A–P	31·7±0·14	1·13±0·10	28·3–35·1	28·8–35·2	3·6
AM	37·3±0·22	1·63±0·15	32·4–42·3	35·2–41·6	4·4
AL	77·8±0·41	3·26±0·29	68·0–87·6	70·4–83·2	4·2
PL	58·1±0·22	2·57±0·23	50·4–65·8	54·4–64·0	4·4
Sens.	32·0 with head 16/19. No variation recorded.				

[1] In a recent letter from my colleague, Dr. G. L. van Eyndhoven I am indebted for the information that an examination of the Oudemans' type slide in Leiden which also contains a specimen of *S. schuffneri* (Walch) (*id.* H. S. Fuller) shows that on the tarsi of leg III of *vandersandei* there is a long nude outstanding seta.

The number of DS given by Oudemans is 52, but they vary somewhat, especially posteriorly, from about 48 to 54. They measure ca. 40μ long, while the ventral setae which number ca. 36, posterior of coxae III measure to 30μ in length. Oudemans only refers to one smooth and one branched hair on the palpal tibia, but as in all species of Trombiculidae there are three setae on this segment, a dorsal and a lateral (both nude) and a ventral which is the branched hair mentioned by Oudemans.

SCHÖNGASTIA (SCHÖNGASTIA) SCHUFFNERI (Walch 1923)

Trombicula schuffneri Walch 1923, Kitasato Archiv. Exper. Med., 5, (3); Tr. Vth. Bien. Cong. Far East. Assoc. Trop. Med., Singapore, 1923 (24).

Neoschöngastia schuffneri, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 117.

Schöngastia katonis Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 104.

Schöngastia pusilla Womersley 1944, Tr. Roy. Soc. S. Austr., 68, (1), 96.

Plate 33, fig. A–E.

Through the kindness of my colleague Dr. G. W. Wharton I have now been able to study a slide of Walch's original material of this species, which he received from Dr. H. E. Ewing who himself had received it from the Koloniaal Institute in Amsterdam. The slide was labelled "in virgin forest, Sumatra 1922". In this specimen the chelicerae are serrated and the sensillae globular as in the genus *Schöngastia*. The dorsal setae are arranged 2.8.2.8.8.? and measure to 40μ long. The Standard Data are: AW 54·5, PW 67·0, SB 21·0, ASB 28·0, PSB 22·0, SD 50·0, A–P 25·0, AM 33·0, AL 56·0, PL 42·0, Sens. 32·0 with the head globular and minutely setulose. The above Standard Data do not differ significantly for those given by Womersley 1944 for 28 specimens of *S. pusilla*, and this species must therefore be regarded as a synonym of *schuffneri* Walch, as it also agrees in other morphological features.

Schöngastia katonis Wom. and Heaslip 1943, erected for the specimen described and figured, but not named, by Kawamura and Yamaguchi 1921 (Kitasato Archiv. Exper. Med. IV) is probably also to be referred to Walch's species.

This species is closely related to *S. vandersandei* (Ouds.), and appears to be almost as common and widespread in New Guinea. It differs from *vander-*

sandei in the smaller scutum and the number and arrangement of the dorsal and ventral setae.

As in the preceding species the AL scutal setae are the longest, the sensillae bases lie in line with or slightly in front of PL, the galcal setae are nude and there is a long nude outstanding seta on tarsi III. The dorsal seta are 2.8.2.8.8.6.4, and the ventral setae 2.2.4.6.6.4.4. The setae on the palpal femur and genu are branched; on the tibia the dorsal and lateral nude, ventral branched. The palpal claw is bifurcate. All legs 7-segmented.

In additon to the 28 specimens of which the Standard Data was recorded in 1944 (under the name *S. pusilla*), the values for another 32 specimens from the following localities: Batisati, N.G., Aug. 1943 (R. N. McCulloch 8 specimens); Dobodura, N.G., Apr. 1943 (D. C. Swan, 7 spec.); Bat. Is., Purdy. Group, June 1944 (G. M. Kohls, 3 spec.); Moratai, Celebes, 1945 (R. N. McCulloch, 2 spec.); Hollandia, D.N.G., Feb. 1945 (R. C. Bushland, 3 spec.); Sansapore, D.N.G., Nov. 1944 (C. Mohr, 4 spec.); Noemfur, D.N.G., Nov. 1944 (D. C. Swan, 5 spec.), are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	53·1±0·49	2·78±0·35	44·7–61·5	48·0–61·2	5·2
PW	70·0±0·36	2·04±0·25	63·9–76·1	67·2–73·6	2·9
SB	20·5±0·24	1·34±0·17	16·5–24·5	19·2–22·4	6·5
ASB	27·0±0·25	1·41±0·18	22·8–31·2	25·6–28·8	5·2
PSB	22·55±0·11	0·61±0·08	20·7–24·6	22·4–25·6	2·7
SD	49·6±0·28	1·60±0·20	44·8–54·4	48·0–54·4	3·2
A–P	23·7±0·24	1·38±0·17	19·6–27·8	20·8–25·6	5·8
AM	27·8±0·37	2·05±0·26	21·7–33·9	25·6–32·0	7·3
AL	54·4±0·49	2·77±0·35	46·0–62·8	48·0–64·0	5·1
PL	43·1±0·58	3·29±0·41	33·2–53·0	38·4–54·4	7·6

Sens. 32·0 with head 12·8/19·2. No variation recorded.

SCHÖNGASTIA (SCHÖNGASTIA) TAYLORI Gunther 1940.

Schöngastia taylori Gunther 1940, Proc. Linn. Soc. N.S. Wales, 65, (3–4), 257, fig. 12–14; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 106.

Plate 33, fig. F–J.

Like the following species, *S. taylori* differs from *vandersandei* and *schuffneri* in having the sensillae bases placed well behind a line joining the PL scutal setae. It has, however, a roughly hexagonal scutum as in those species but the anterior lateral sides are much shorter than the posterior-lateral sides, i.e. A–P is relatively short and less than half as long as the scutal depth. In

addition the dorsal setae are more numerous, ca. 80 and arranged ca. 2.10.2.13. 2.14.12.12.8.4.

As stated by Womersley and Heaslip (1943) Gunther gives PL as longer than AL and figures it so. This however, is not borne out by the examination of the type and 4 paratypes of Gunther's material, AL being the longest. The setae on the femur and genu of the palpi are well branched, on the tibia the dorsal and lateral are nude and the ventral branched. The galeal setae are nude. Tarsi III is provided with a long nude outstanding seta.

This species was described from *Macropus* (*Thylogale*) *coxeni* Gray from Bulolo, N.G. No fresh material has since been seen, and the following Standard Data is derived from the type and 4 paratypes as recorded by Womersley and Heaslip 1943.

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	62·4±0·40	0·89±0·28	59·7–65·1	61·0–63·0	1·4
PW	79·0	No variation recorded			
SB	21·2±0·20	0·45±0·14	19·85–22·55	21·0–22·0	2·1
ASB	35·0	No variation recorded			
PSB	23·5	No variation recorded			
SD	58·5	No variation recorded			
A–P	23·5	No variation recorded			
AM	41·0±0·71	1·41±0·50	36·8–45·2	40·0–43·0	3·4
AL	77·6±1·29	2·88±0·91	69·0–86·2	73·0–81·0	3·7
PL	57·0±1·22	2·45±0·87	49·7–64·3	55·0–60·0	6·6

Sens. 35·0 with head 15/28. Only 1 determination.

SCHÖNGASTIA (SCHÖNGASTIA) WHARTONI sp. n.

Plate 34, fig. A–E.

Description of Larvae. Shape roughly oval. Length (unengorged) 200μ, width 154μ. Dorsal scutum as figured, with anterior margin lightly sinuous, the lateral margins short and PL near to AL, posterior margin deeply and evenly rounded; AL the longest; sensillae globular, nude with their bases behind a line joining PL. Eyes 2 + 2, on ocular shields and adjacent to the postero-lateral scutal angles. Chelicerae fairly long with numerous teeth on the inner (dorsal) margin. Palpi fairly stout; tibial claw bifurcate, prongs unequal; setae on palpal femur and genu branched, on tibia dorsal and lateral nude, ventral branched; tarsus with subapical and sub-basal nude rod-like setae and 4 or 5 ciliated setae. Dorsal setae 36 in number, arranged 2.8.8.6.6.4, to 35μ long. Ventrally with the usual pair of maxillary setae, one on each coxa, a pair between coxae I and between coxae III, and thereafter 2.6.4.4.4.2.2. to 22μ long. Legs I 230μ long, II 210μ, III 240μ; tarsi I and II

with the usual dorsal rod-like sensory seta, III with a long nude outstanding seta. The Standard Data for the type and 3 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	50·4±0·80	1·60±0·57	45·6–55·2	48·0–51·2	1·6
PW	64·0	No variation recorded			
SB	18·0±0·77	1·53±0·54	13·4–22·6	16·0–19·2	8·5
ASB	25·6	No variation recorded			
PSB	22·4	No variation recorded			
SD	48·0	No variation recorded			
A–P	14·4±0·92	1·85±0·65	8·8–20·0	12·8–16·0	12·8
AM	34·4±1·53	3·06±1·09	25·2–43·6	32·0–38·4	9·0
AL	56·8±0·80	1·60±0·57	52·0–61·6	54·4–57·6	1·4
PL	49·6±0·92	1·85±0·65	44·0–55·2	48·0–51·2	1·9
Sens.	32·0 with head 16/22. No variation recorded.				

Loc. The type and 3 paratypes taken on boots in the scrub at Lae, N. Guinea, March 1944 (R. N. McCulloch).

Remarks. In having the sensillae bases well behind line of PL, A–P much shorter than the scutal depth, and the palpal claw bifurcate, this species is closely related to *S. taylori* Gunther. It differs in the number of dorsal setae and the shape of the scutum. It is a pleasure to name it after Dr. G. H. Wharton, of Duke University, Durham, N. Carolina, U.S.A.

b. *Palpal claw trifurcate.*

SCHÖNGASTIA (SCHÖNGASTIA) BIDENTATA sp. n.

Plate 34, fig. F–J.

Description of Larva. Shape oval. Length (engorged) to 355μ, width to 255μ. Scutum pentagonal, strongly but sparsely punctate, the posterior portion tending to be overlapped by the striated dorsal cuticle; scutal setae rod-like, blunt tipped, with minute adpressed ciliations; PL setae the longest; sensillae clavate, ciliated, their bases about in line with PL. Eyes fairly large, 2 + 2, on ocular shields adjacent to postero-lateral angles of scutum. Chelicerae, besides the usual tricuspid cap, with only two subapical teeth on inner margin. Galeal setae nude. Palpi stout; tibial claw trifurcate; all setae on femur, genu and tibia of palpi nude. Dorsal setae stiff and rod-like, blunt, with short adpressed ciliations, to 22μ long, 30–31 in number and arranged 2.8(9).6.6.4.4. Ventrally with the usual pair of maxillary setae, one on each coxa, a pair between coxae I and between coxae III and thereafter 2.6.4.4.2.2.2., to 20–22μ long. Legs I 240μ long, II 224μ, III 248μ; tarsi I and II with a

long nude outstanding seta. The Standard Data for the type and 7 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	53·55±0·62	1·75±0·44	48·3–58·8	54·4–57·6	3·3
PW	69·7±0·46	1·30±0·32	65·8–73·6	67·6–70·4	1·8
SB	22·0±0·40	1·13±0·28	18·6–25·4	19·2–22·4	5·1
ASB	22·8±0·40	1·13±0·28	19·4–26·2	22·4–25·6	4·9
PSB	22·4	No variation recorded			
SD	45·2±0·40	1·13±0·28	41·8–48·6	44·8–48·0	2·5
A–P	26·8±0·58	1·66±0·41	21·8–31·8	25·6–28·8	6·2
AM	16·0	No variation recorded			
AL	28·8	No variation recorded			
PL	32·0	No variation recorded			
Sens.	32·8±0·80	1·60±0·32	28·0–37·6	32·0–35·2	5·0

Loc. and Host. The type and 7 paratypes from the axilla of a skink, 60 miles south of Darwin, N.T., Australia, 13th May, 1943 (R. V. Southcott).

Remarks. Amongst the species of *Schöngastia* this species is very characteristic in the shape of the scutum, and the dorsal setae. In having only two teeth on the chelicerae it is rather a connecting link between the species of *Schöngastia* s. str. and *Ascoschöngastia.*

SCHÖNGASTIA (SCHÖNGASTIA) VIETA Gater 1932.

Schöngastia vieta Gater 1932, Parasitology, 24, 154, fig. 5; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 103.

Plate 35, fig. A–E.

This species is closely related to the preceding, in having a more or less pentagonal scutum. It differs, however, in having globose sensillae which are indistinctly villous, in the scutal and dorsal setae being tapering and normally long ciliated, and in AL being the longest of the scutal setae. The chelicerae have more than the two inner teeth. The palpal setae on the femur and genu are shortly branched, often appearing to be nude. The sensillae are indistinctly setulose or villous. The dorsal setae number 32 and are arranged 2.8.6.6.6.4.2, sometimes 2.10.8.6.4.2, and measure to 35μ in length. The ventral setae posterior of coxae III are 6.6.6.6.4.2 approximately. All coxae 1-setose. Tarsi of leg III with a long nude seta.

The Standard Data from the type and 3 paratypes in the British Museum (Nat. Hist.) measured while in London in 1947, and one paratype in the S.A. Museum collection are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	53·8±0·96	2·15±0·67	47·4–60·2	52·8–57·6	4·0
PW	73·0±1·04	2·22±0·74	66·1–79·9	70·4–76·8	3·2
SB	19·7±0·18	0·40±0·13	18·5–20·9	19·2–19·8	2·0
ASB	26·2±0·16	0·36±0·11	25·1–27·3	25·6–26·4	1·3
PSB	26·9±0·48	1·07±0·34	23·8–30·1	26·4–28·8	4·0
SD	53·1±0·32	0·72±0·23	51·0–55·2	52·8–54·4	1·35
A–P	30·8±0·25	0·56±0·18	29·1–32·5	30·0–31·6	1·8
AM	28·2±0·84	1·88±0·60	22·6–33·8	25·0–30·0	6·6
AL	60·3±2·05	4·60±0·45	46·5–74·1	55·0–66·0	7·6
PL	50·7±0·99	2·21±0·70	44·1–57·0	48·4–52·8	4·4
Sens.	39·3±0·70	0·99±0·50	36·3–41·4	38·4–40·0	2·4

Amongst the large collection of Trombiculids collected by T. J. Lawrence in Southern Burma in Nov. 1945 are 39 specimens of this species. The specimens were from *Rattus rattus* and *Nesokia bengalensis*, and all from the neighbourhood of Toungoo, S.B.

The Standard Data of these 39 specimens are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	55·5±0·33	2·09±0·24	49·3–61·7	51·2–60·8	3·8
PW	78·2±0·34	2·14±0·24	71·8–84·6	73·6–83·2	2·7
SB	19·4±0·12	0·74±0·08	17·2–21·6	19·2–22·4	3·8
ASB	28·8	No variation recorded			
PSB	25·6	No variation recorded			
SD	54·4	No variation recorded			
A–P	31·2±0·26	1·61±0·18	26·4–36·0	28·8–32·0	5·1
AM	29·1±0·15	0·97±0·11	26·2–32·0	28·8–32·0	3·3
AL	70·2±0·40	2·48±0·28	62·8–77·6	64·0–76·4	3·5
PL	54·8±0·23	1·41±0·16	50·6–59·0	51·2–60·8	2·6
Sens.	32·0 with head 16/19. No variation recorded.				

SCHÖNGASTIA (SCHÖNGASTIA) PHILIPI Wom. and Kohls 1947.

Schöngastia philipi Womersley and Kohls 1947. Tr. Roy. Soc. S. Aust. 71, (1), 6.

Plate 35, fig. F–J.

This species was described from the type and 9 paratypes from a skink *Leiolopisma albertisii* from Goodenough Island, N.G. (coll. Jan. 17, 1944, G. M. Kohls No. 486).

The scutum is hexagonal as in the species *vandersandei, schuffneri, blestowei* and *b.* var. *megapodius,* but it only agrees with *blestowei* and its variety in having a trifurcate palpal claw.

From *blestowei* (and *megapodius*) it differs as in the key, in the smaller scutum, the smaller number of dorsal setae, and in the seta on the palpal genu being nude.

The Standard Data for the type and 9 paratypes in the S.A. Museum collection as given by Wom. and Kohls 1947 are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	48·6±1·12	2·51±0·80	41·1–56·1	45·0–51·0	5·1
PW	69·6±0·40	0·89±0·28	66·9–72·3	68·0–70·0	1·3
SB	18·4±0·40	0·89±0·28	15·7–21·1	18·0–20·0	4·8
ASB	24·0	No variation recorded			
PSB	21·0	No variation recorded			
SD	45·0	No variation recorded			
A–P	23·6±0·40	0·89±0·28	20·9–26·3	22·0–24·0	3·8
AM	22·2±0·73	1·64±0·52	17·3–27·1	21·0–24·0	7·4
AL	59·2±0·49	1·09±0·35	55·9–62·5	58·0–60·0	1·8
PL	42·6±1·12	2·51±0·80	35·1–50·1	39·0–45·0	5·9
Sens.	30·0 with head 15/18. Only 1 determination.				

SCHÖNGASTIA (SCHÖNGASTIA) BLESTOWEI Gunther 1939.

Schöngastia yeomansi Gunther 1938, Med. J. Aust., 2, (6), 202, (nom. nud.).

Schöngastia blestowei Gunther 1939, Proc. Linn. Soc., N.S. Wales, 64, (1–2), 92; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 103; Womersley 1944, *idem*, 68, (1), 97 (in part).

Plate 36, fig. A–E.

Gunther originally described this species from a number of specimens from two men near the Suein River, Sepik District of New Guinea. At the same time he also recorded as the same some specimens from the ears of a bush fowl (*Megapodius duperreyi*) from Bulolo River Basin, Morobe District.

On the difference in size of the scutum and in the Standard Data, the specimens from *Megapodius* were distinguished from those from the Suein River, by Womersley and Heaslip (1943), as a variety under the name of *megapodius*. In addition to these differences, the scutal, palpal and dorsal setae are much longer branched in *megapodius* than in the typical form. Also in the variety in front of each sensilla base is a distinct semicircle not found in the typical specimens. More characteristic even is the much wider distance between the sensillae bases in *megapodius*. In typical *blestowei* the dorsal setae are rather variable; Gunther gives the number as up to 64, whereas the figure given here shows 54. The latter number is approximately that found in

vandersandei with which Gunther contrasts *blestowei* (1939). The two species however, are very distinct on the character of the palpal claw.

The following Standard Data for the typical form are from the figures given by Womersley and Heaslip 1939 for Gunther's Suein River specimens with the following additional records: ? Solomons 1945 (4 spec. L. A. Posekany); on boots, island north of Bougainville Aug. 1945 (8 spec. G. H. McQueen); on man, Treasury Islands, Jan. 1944 (7 spec. L. J. Dumbleton); a total of 26 specimens.

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	65·7±0·51	2·58±0·36	58·0–73·4	60·8–73·6	3·8
PW	86·0±0·66	3·35±0·46	76·0–96·0	76·8–91·0	3·9
SB	25·9±0·18	0·92±0·12	23·1–28·7	24·0–28·8	3·5
ASB	32·8±0·32	1·65±0·23	27·8–37·8	28·8–34·0	5·0
PSB	27·0±0·34	1·73±0·24	21·8–32·2	25·6–31·0	6·3
SD	59 8±0·36	1·85±0·26	54·2–66·4	57·6–64·0	3·1
A–P	30·4±0·31	1·60±0·22	25·6–35·2	28·8–35·2	5·2
AM	34·9±0·42	1·97±0·30	29·0–40·8	32·0–40·0	5·6
AL	67·1±0·61	3·01±0·43	58·1–76·1	64·0–73·6	4·5
PL	51·35±0·47	2·40±0·33	44·15–58·55	48·0–54·4	4·7
Sens.	33·5±0·34	1·53±0·24	28·9–38·1	32·0–35·2	4·6

var. MEGAPODIUS Wom. and Kohls 1943.

Tr. Roy. Soc. S. Aust., 67, (1), 104.

Plate 36, fig. F–J.

The following Standard Data is derived from the type slide in the S.A. Museum containing 3 specimens of Gunther's *S. blestowei* from *Megapodius duperreyi,* together with 4 specimens collected on boots in scrub at Lae, N.G. Apr. 1944 (R. N. McCulloch) and 7 specimens from a *Megapodius* mound at Dobodura, N.G., 13 July 1944 (coll. G. M. Kohls, No. 506); 14 specimens in all.

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	57·7±0·52	1·94±0·37	51·9–63·5	54·4–60·8	3·3
PW	80·3±0·47	1·75±0·33	75·1–85·5	76·8–83·2	2·2
SB	32·2±0·21	0·80±0·15	29·8–34·6	32·0–35·0	2·4
ASB	30·2±0·55	2·07±0·39	24·0–36·4	26·0–32·0	6·8
PSB	23·0±0·29	1·09±0·21	19·7–26·3	22·4–26·0	4·7
SD	53·2±0·39	1·46±0·27	48·8–57·6	51·2–54·4	2·7
A–P	24·4±0·64	2·38±0·45	17·3–31·5	20·0–25·6	9·8
AM	38·55±0·30	1·04±0·21	35·4–41·7	37·0–41·6	2·7
AL	67·65±0·90	3·12±0·64	58·3–77·0	63·0–70·4	4·6
PL	57·2±0·56	2·01±0·39	51·2–63·2	54·4–62·0	3·5
Sens.	33·15±0·76	2·77±0·54	24·85–41·45	30·0–38·4	8·3

SCHÖNGASTIA (SCHÖNGASTIA) OCULICOLA sp. n.

Plate 37, fig. A–E.

Description of Larva: Shape oval. Colour in life unknown. Length (engorged) to 420μ, width to 350μ. Scutum relatively small, as in figure, with the anterior margin sinuous, lateral margins lightly concave, and the posterior margin laterally lightly concave, medially convex; scutal setae slender and tapering with only short adpressed ciliations; Pl the longest, AM the shortest; sensillae globose, ciliated with their bases fairly near together and well in advance of line of PL. Eyes 2 + 2, indistinct. Chelicerae short, curved and stout, the apical tricuspid cap prominent, on the dorsal edge a strong subapical forwardly directed tooth, and more proximally some fine indistinct rounded teeth. Galeal setae nude. Palpi rather stout; tibial claw large and strong with 2 large subequal prongs, and 1 smaller shorter prong; seta on palpal femur and genu with indistinct short branches; on tibia, dorsal and lateral nude, ventral branched; tarsus with a subapical nude seta, a dorsal sub-basal sensory rod and 4 or 5 ciliated setae. Dorsal setae to 42μ long, fine, with only short adpressed ciliations, 36 in number, arranged 4.6.8.8.6.4, i.e. 2 humeral setae on each side. Ventrally: with the usual pair of maxillary setae, one on each coxa, a pair between coxa I and between coxae III and thereafter 6.8.8.8.6.2 somewhat shorter than the dorsal setae. Legs all 7-segmented; I 260μ long, II 227μ, III 240μ; tarsi I and II with the usual dorsal sensory rod; III without any long nude outstanding seta.

The Standard Data derived from two larvae and one larval pelt are: AW 44·8, PW 71·5 (70·4–73·6), SB 16·0, ASB 22·4, PSB 19·2, SD 41·6, A–P 29·9 (28·8–32·0), AM 16·0, AL 36·0, PL 48·0, Sens. 22·0 with head 16/16.

Host and Loc. This species is described from the type and paratype (and a recovered larval pelt from rearing experiments) from the conjunctival sacs of *Leggada booduga fulvidiventris* (Blyth) from Nalanda, Ceylon, July 1944.

Mr. S. H. Jayewickreme of the Division of Medical Entomology, Colombo, to whom I am indebted for the above material and also the proposed name, has successfully reared the larvae through to the nymph as described in another part of this paper.

SCHÖNGASTIA (SCHÖNGASTIA) PSEUDOSCHUFFNERI (Walch 1927).

Trombicula pseudoschuffneri Walch 1927, Geneesk. Tijds. v. Ned. Indie, 67, (6), 922.

Neoschöngastia pseudoschuffneri, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust. 67, (1), 117.

Schöngastia n. sp. "X." Lawrence in MS. In Audy 1947. "Scrub Typhus Investigations in S.E. Asia, Pt. III. Appendix 7." AMD. 7. War Office, London.

Plate 37, fig. F–J.

This species does not appear to have been recognized hitherto, since the original description from specimens taken on rats from the Lampong District of Macassar. It was wrongly placed in *Neoschöngastia* (*Ascoschöngastia*) by Womersley and Heaslip through an oversight of Walch's statement that the chelicerae were saw-like.

However, I have recently been able to examine 5 specimens collected from *Rattus rattus diardi* from Batavia by Dr. R. Gispin (coll. Nov. 1948) which he considered could be referred to Walch's species. After a careful study of this material I can confirm Dr. Gispin's identification.

The chelicerae are serrate and the galeal setae nude. Palpal claw trifurcate and the seta on palpal femur lightly branched, on genu rather less so, on tibia nude except the ventral. The scutum is not hexagonal, the posterior margin being rounded laterally and rather flattened medially. Sensillae distinctly globose or capitate, and ciliated. AL the longest. Eyes 2 + 2, ocular shields apparently absent. Dorsal setae 34, arranged 2.8.6.6.6.4.2 or 2.8.8.6.4.4.2. Ventral setae posterior of coxae III are 8.4.4.4.4.2 approximately. Legs all 7-segmented, tarsi III with a long nude seta.

The Standard Data for these specimens are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	57·0±2·12	4·75±1·50	42·8–71·2	51·2–64·0	8·3
PW	78·1±1·63	3·65±1·15	67·2–89·0	73·6–83·2	5·0
SB	22·4	No variation recorded			
ASB	25·6	No variation recorded			
PSB	23·05±0·39	0·88±0·28	20·4–25·7	22·4–24·0	3·8
SD	48·65±0·39	0·88±0·28	46·0–51·3	48·0–49·0	1·8
A–P	28·8	No variation recorded			
AM	26·2±0·64	1·43±0·45	21·9–30·5	25·6–28·8	5·4
AL	66·1±1·33	2·97±0·94	57·2–75·0	64·0–70·4	4·5
PL	53·9±0·48	1·07±0·34	50·7–57·1	52·0–54·4	2·0
Sens.	32·0 with head 13/19. No variation recorded.				

The following specimens from Burma, mainly in material in the British Museum and sent to me for study and determination are also to be referred to *S. pseudoschuffneri* (Walch): On *Rattus rattus brunneusculus* Hodgson, Imphal, Burma, 7 Nov., 1945 (T. J. Lawrence, 4 specimens); on *Nesokia bengalensis* 24 Sept., 1945, 1 mile S. of stream, Paungde, Burma (T.J.L. No. 721, 5 specs., No. 722, 6 specs., No. 723, 3 specs.); on *N. bengalensis*, 25 Sept., 1945, 1 mile

S. of stream, Paungde, Burma (T.J.L. No. 728, 14 specs., No. 729, 7 specs.). Total of 49 specimens.

These 49 specimens have the following Standard Data:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	53·9±0·24	1·69±0·17	48·8–59·0	51·2–57·6	3·1
PW	78·4±0·35	2·42±0·25	71·1–85·7	73·6–86·4	3·1
SB	20·8±0·21	1·50±0·16	16·3–25·3	19·2–22·4	7·2
ASB	29·0±0·19	1·31±0·13	25·1–32·9	25·6–32·0	4·5
PSB	25·3±0·13	0·88±0·09	22·65–27·95	22·4–25·6	3·5
SD	54·3±0·21	1·47±0·15	49·9–58·7	51·2–57·6	2·7
A–P	31·4±0·20	1·40±0·14	27·2–35·6	28·8–35·2	4·4
AM	33·0±0·34	2·24±0·24	26·3–39·7	28·8–38·4	6·8
AL	74·5±0·65	4·27±0·46	61·7–87·2	70·4–86·4	5·7
PL	59·4±0·44	2·98±0·31	50·5–68·3	54·4–64·0	5·0
Sens.	35·2 with head 13/19. No variation recorded.				

SCHÖNGASTIA (SCHÖNGASTIA) MALDIVIENSIS Radford 1946.

Schöngastia maldiviensis Radford 1946, Parasitol., 37, 48, fig. 9–12.

Plate 38, fig. A–E.

This species was somewhat briefly described and figured from specimens from a lizard (*Calotes versicolor*) and occasionally from *Rattus norvegicus norvegicus* from the Maldive Islands. I am indebted to Dr. Radford for two specimens, from which I give the following description.

The length is 300μ, width 210μ (engorged or partially so). Scutum as figured, anterior margin almost straight, posterior evenly rounded, surface punctate. AL the longest, sensillae bases slightly in front of line of PL, and with a crescent-shaped line in front and behind; sensillae globose, ciliated. Eyes 2 + 2, ocular shields apparently absent, close to the postero-lateral corners of scutum. Chelicerae strong, curved, with strong inner serrations. Galeal setae nude. Palpi stout, claw trifurcate with median prong the longest; setae on femur and genu strongly branched; on tibia dorsal and lateral nude, ventral branched. Dorsal setae ca. 34 in number and arranged ca. 2.8.6.6.6.4.2, to 32μ long. Ventral setae, the usual pair of maxillary, one on each coxa, a pair between coxae I and between coxae III and thereafter 4.6.6.6.4.4.2. Legs I 330μ long, II 300μ, III 330μ; tarsi I and II with the usual dorsal sensory rod, III with a long outstanding nude seta.

The Standard Data for these two specimens are: AW 51·2, 51·2, PW 67·2, 64·0, SB 16·0, 16·0, ASB 25·6, 25·6 PSB 25·6, 25·6, SD 51·2, 51·2, A–P 28·8, 28·8, AM 25·6, 28·8, AL 54·4, 54·4, PL 48·0, 48·0, Sens. —, 32·0 with head 15/20.

CHELICERAE NOT SERRATED.

Subgenus ASCOSCHOENGASTIA Ewing 1946.

Neoschöngastia Ewing 1929, Manual of External Parasites, p. 187 (in part); Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 106; Sig Thor and Willmann 1947, Das Tierreich, 3, 71b, 310.

Ascoschöngastia Ewing 1946, Proc. Biol. Soc. Washington, 59, 69–72.

Dr. H. E. Ewing 1946 showed that the genus *Neoschöngastia* with *americana* Hirst as type was synonymous with *Paraschöngastia* Womersley 1939, and that the non-serrate chelicerae, the sensillae bases being inserted in a transverse wall or crest of the scutum, and the posterior part of the scutum being overlapped by the dorsal cuticle with semicircular striations, characteristic of *Paraschöngastia* were also features of *Neoschöngastia americana.*

For the other species with non-serrate chelicerae, and a simple type of scutum Ewing proposed (1946) the generic name of *Ascoschöngastia,* designating a somewhat aberrant species, *Neoschöngastia malayensis,* as type.

As shown in the adult and nymphal section of the present work, the genera cannot be separated in these stages, and it seems doubtful whether the serration of the chelicerae in the larvae can be regarded as of more than of subgeneric value. Consequently here *Ascoschöngastia* is given only as a subgenus of the older genus.

This is supported by the fact that the number of cheliceral teeth varies in the different species and in some *Schöngastia* species (e.g. *bidentata* sp. n.) approaches the non-serrate type.

The genus *Euschöngastia* was erected by Ewing, 1938 (Wash. Acad. Sci., 28, (6), 293) with *Euschöngastia americana* sp. n., as type, on the basis of the palpal claw having five or seven prongs. In 1946 Ewing (Proc. Biol. Soc. Wash., 59, 69–72) also erected the genus *Ascoschöngastia,* for those species with non-serrate chelicerae and with bi- or trifurcate palpal claw, but without the characters of the scutum of *Neoschöngastia* 1929 (Manual External Parasites, p. 127). For *Ascoschöngastia* he designated as type, *Neoschöngastia malayensis* Gater 1932, a species characterized by having only 3 scutal setae, i.e. AM and AL, both PL being situated off the scutum.

Wharton 1948 (Psyche, 55, (2), 90) in describing *phylloti* from Peru, with 3 prongs to the palpal claw placed it in *Euschöngastia* and proposed to expand Ewing's usage of this generic name to embrace such species, and to restrict *Ascoschöngastia* to species with PL off the scutum.

As there are no generic differences to be found in the nymphs or adults which will separate *malayensis* from the other species of *Ascoschöngastia,* it seems that such a character as exhibited by *malayensis* larvae can hardly be valid generically. A similar shortening of the scutum so as to exclude the PL setae, as well as a multipronged palpal claw, also occurs in the genus *Tecomatlana* Hoffman 1947 (= *Sauriscus* Lawrence 1949).

Further, the variation in the number of prongs in the palpal claw is also of little, if any, generic value and, at most, should only be used subgenerically.

These considerations then, show that *Euschöngastia* Ewing is identical with *Ascochöngastia* Ewing, over which it has many years' priority, and should in all probability be used in place of *Ascoschöngastia* in this paper.

The subgenus *Ascoschöngastia* Ewing may be diagnosed as follows: Larval Trombiculid mites in which the dorsal scutum carries 5 normal ciliated setae, and a pair of clavate or globose sensillae whose bases are not set in a transverse wall or crest. The posterior part of the scutum not overlapped by the dorsal cuticle and without striations. Chelicerae non-serrate on inner (dorsal) margin; with only the usual apical tricuspid cap.

1. SOME OR ALL DORSAL, AS WELL AS PL AND SOMETIMES AL OR AM FOLIATE.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) PSEUDOMYS sp. n.

Plate 39, fig. A–E.

Description of Larvae: Shape oval. Length (partially engorged) 450μ, width 300μ. Dorsal scutum as figured, with PL setae long, foliate and placed slightly nearer to AL, than to the posterior margin; anterior scutal margin slightly sinuous, posterior with widely rounded corners; AL very short and shorter than AM, both AM and AL not foliate; sensillae missing but bases behind line of PL. Eyes 2 + 2, on ocular shields, closely adjacent to scutum on a level with PL; posterior eyes the smaller. Chelicerae with only the apical tricuspid cap. Galeal seta strongly branched. Palpi as figured, with trifurcate tibial claw, and all setae on femur, genu and tibia strongly ciliated, tarsi with sub-basal and subapical nude sensory setae and 4 or 5 ciliated setae. Dorsal setae 38 in number to 85μ long, all except the posterior 4 long and foliate, with the edges with short ciliations, arranged 2.8.6.6.6.6.2.2. Ventrally with all setae fine and ciliate, a pair between coxae I and between coxae III, and thereafter 8.6.6.4.4.2, to 40μ long. Legs all 7-segmented, I 260μ long, II 240μ, III 270μ tarsi I and II with the usual dorsal sensory rod, III without any long nude seta.

The Standard Data for the type and two paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	70·4	No variation recorded			
PW	84·3±1·07	1·85±0·75	78·7–89·9	83·2–86·4	2·2
SB	32·0±1·87	3·20±1·31	22·4–41·6	28·8–35·2	10·0
ASB	28·8	No variation recorded			
PSB	24·5±0·54	0·93±0·38	21·7–27·3	24·0–25·6	3·8
SD	52·3±1·40	2·43±1·00	45·0–59·6	49·6–54·4	4·6
A–P	16·0	No variation recorded			
AM	54·4	No variation recorded			
AL	25·6	No variation recorded			
PL	81·1±1·07	1·85±0·75	75·5–86·7	80·0–83·2	2·3
Sens.		Missing.			

Loc. and Host. The type and two paratypes in the S.A. Mus. coll. from a *Pseudomys* sp. from Johnston's Pass, Wongabel, Queensland, 13 Feb., 1945 (R. N. McCulloch).

Remarks. Although the sensillae are missing from all three specimens, this species is probably correctly placed in the subgenus *Ascoschöngastia*. It can be separated as in the key, on the palpal setae and on the foliate scutal and dorsal setae.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) MCCULLOCHI (Wom. 1944).

Neoschöngastia mccullochi Womersley 1944, Tr. Roy. Soc. S. Aust., 68, (1), 100.

Plate 39, fig. F–K.

This species has not been seen since the unique specimen was described.

In addition to the details given in the original description the following are to be noted.

The galeal setae are nude. The palpal claw is trifurcate, and all seta on the palpal femur, genu and tibia are nude. There is no long nude seta on tarsi III.

The Standard Data as given in 1944 are: AW 48·0, PW 67·0, SB 19·0, ASB 19·0, PSB 16·0, SD 35·0, A–P 20·0, AM 16·0, AL 42·0, PL 64·0, Sens. 32·0, with head 17 × 17 and nude. The dorsal setae are 2.6.6.6.4.2, and as figured.

The type and unique specimen in the S.A. Museum collection was collected on boots at Abidari, New Guinea, 28th July, 1943 (R. N. McCulloch).

SCHÖNGASTIA (ASCOSCHÖNGASTIA) UROMYS (Wom. and Kohls 1947).

Ascoschöngastia uromys Wom. and Kohls 1947, Tr. Roy. Soc. S. Aust., 71, (1), 10.

Plate 40, fig. A–F.

This species was described from the type and 7 paratypes from *Uromys lamington* from Dobodura, New Guinea.

It belongs to a small group of species, including *foliata* Gunther, *mccullochi* Wom. and *pseudomys* sp. n., in having some of the scutal setae and most of or all the dorsal setae lanceolate or narrowly foliate. The original description of the larvae was as follows: "Shape oval. Length (unengorged) 300μ, width 200μ. Scutum roughly rectangular with fairly well

produced posterior margin. AM short and normally ciliated, AL and PL lanceolate or foliate, to 16μ wide with longitudinal rows of strong dentures. Sensillae globose, apparently nude, with the bases only slightly in advance of line of PL. Eyes 2 + 2, on distinct ocular shields; posterior the smaller. Chelicerae with only the usual apical tricuspid cap. Galeal setae nude. Palpi fairly stout, with bifurcate tibial claw. Setae on palpal femur, genu and tarsi apparently all nude. Dorsal setae all foliate or lanceolate with strong dentures, to 64μ long and 16μ wide, 28 in number and arranged 2.6.6.6.6.2. Ventrally with usual pair of branched setae on gnathosoma, a single ciliated seta on each coxa, a pair between coxae I and between coxae III and thereafter 5.6.6 anterior of anus, and of which the outer two of the second six approach the dorsal setae in form; then posterior of anus 4.2, foliate and dentate as on dorsum; the anterior non-foliate ventral setae to 20μ long. Legs: I 270μ long, II 220μ, III 270μ; tarsi I and II with the usual sensory rod, III without any long nude seta.

The Standard Data derived from the type and seven paratypes are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	50·6±1·74	4·92±1·23	35·8–65·4	45·0–60·4	9·7
PW	69·5±0·71	2·00±0·50	63·5–75·5	66·0–75·0	2·9
SB	19·0±0·50	1·41±0·35	14·8–23·2	18·0–21·0	7·4
ASB	21·0	No variation recorded			
PSB	18·0	No variation recorded			
SD	39·0	No variation recorded			
A–P	21·6±0·42	1·19±0·30	18·0–25·2	21·0–24·0	5·5
AM	16·5±0·67	1·64±0·47	11·6–21·4	15·0–18·0	9·9
AL	49·5±0·67	1·64±0·47	44·6–54·4	48·0–51·0	3·3
PL	60·0±0·57	1·60±0·40	55·2–64·8	57·0–63·0	2·7
Sens.	28·0 with head 17/17. Only 1 determination.				

Remarks: No fresh material of this species has been collected.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) FOLIATA (Gunther 1940).

Neoschöngastia foliata Gunther 1940, Proc. Linn. Soc., New South Wales, 65, (3–4), 255; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 112.

Plate 40, fig. G–I.

In addition to the details given by Womersley and Heaslip 1943, it must be stated that according to Gunther (1940) the palpal claw is trifurcate, the setae on the palpal femur and genu are branched or ciliated, and on the

tibia the dorsal and lateral setae are nude and the ventral branched. The chelicerae are simple, with only the apical tricuspid cap, and the galeal setae are nude. The dorsal setae are 2.6.6.6.6.4.2, to 62μ long.

The Standard Data for 5 paratypes as given by Womersley and Heaslip and statistically treated are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	53·2±1·52	3·42±1·08	43·0–63·5	50·0–58·0	6·4
PW	69·6±0·68	1·52±0·48	65·1–74·1	68·0–71·0	2·1
SB	17·1±0·37	0·82±0·26	14·7–19·5	16·5–18·0	4·8
ASB	19·3±0·44	0·97±0·38	16·4–22·2	18·0–20·0	5·0
PSB	17·2±0·34	0·74±0·24	14·9–19·5	16·5–18·0	4·4
SD	36·5±0·67	1·50±0·47	32·0–41·0	35·0–38·0	4·1
A–P	25·0	No variation recorded			
AM	20·6±0·98	2·19±0·69	14·0–27·2	18·0–24·0	10·6
AL	58·7±2·33	4·04±1·65	46·6–70·8	55·0–63·0	6·9
PL	86·6±1·69	3·78±1·19	75·2–98·0	83·0–91·0	4·4
Sens.	28·0 with head 17/17. No variation recorded.				

This species is as yet only known from the original material from the ears of *Macropus* (*Thylogale*) *coxeni* Gray, from Bulolo, New Guinea.

II. No Dorsal or Scutal Setae Foliate.

(A) SENSILLAE GLOBOSE.

Schöngastia (Ascoschöngastia) signata sp. n.

Plate 41, fig. A–D.

Description of Larvae. Shape elongate oval. Length (unfed) 220μ, width 140μ; (engorged) to 480μ and 300μ. Scutum as figured, rectangular, with anterior margin shallow behind line of PL, almost straight; sensillae globular, apparently nude, and with their sensillae bases placed less than their own diameter apart, and well in front of line of PL; A–P greater than 3/4 SD; AM setae the shortest, PL the longest. Eyes 2 + 2, the posterior the shorter. Chelicerae with only the apical tricuspid cap. Galeal setae nude. Palpal setae all ciliated or branched. Dorsal setae fairly long and slender, 36 in number arranged ca. 2.10.8.6.6.4 to 54μ long. Ventrally with the usual pair of branched setae on maxillae, a long ciliated seta on each coxa, a pair between coxae I and between coxae III, thereafter about 26 setae. Legs I 288μ, II 224μ, III 272μ, tarsi I and II with the usual dorsal sensory rod, tarsi III without any long nude setae.

The Standard Data for the type and 11 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	41·9±0·27	0·92±0·19	39·1–44·7	41·6–44·8	2·0
PW	64·0	No variation recorded			
SB	12·5±0·18	0·62±0·13	10·6–14·4	11·2–12·8	5·0
ASB	22·4	No variation recorded			
PSB	11·6±0·29	0·99±0·20	8·6–14·6	9·6–12·8	8·6
SD	34·0±0·29	0·99±0·20	31·0–37·0	32·0–35·2	2·9
A–P	31·5±0·23	0·79±0·16	29·2–33·8	30·4–32·0	2·5
AM	29·4±0·58	1·93±0·41	23·6–35·2	25·6–32·0	6·5
AL	63·4±0·84	2·80±0·59	55·0–71·8	57·6–67·2	2·6
PL	70·9±0·88	2·77±0·62	62·6–79·2	67·2–73·6	3·9
Sens.	35·2 with head 19·6/22·4. No variation recorded.				

Loc. and Hosts. The type and eleven paratypes collected on boots by Maj. R. N. McCulloch, June, July and October, 1945, at Brunei and Labuan, North Borneo.

Remarks. In the small group of species with closely approximate sensillae bases this species is, in the shape of the scutum, most closely allied to *mutabilis* Gater. From this it differs in having PL setae the longest, in the number of DS and in having all coxae unisetose. It also has the sensillae nude, and all palpal setae ciliated.

SCHÖNGASTIA (ASCOSCHÖNGASTIA)? GLOBULARE (Walch, 1927).

Trombidium (*Trombicula?*) *globulare* Walch, 1927. Geneesk. Tijdschr. v. Ned. Indie. 67, (6), 929, fig. 7.8.9;

Neoschöngastia globulare, Womersley and Heaslip, 1943. Trans. Roy. Soc. S. Aust., 67, (1), 114.

Plates 41, fig. E–F; 42, fig. A–B.

This species does not appear to have been met with since Walch first recorded it from rats from the Macassars. According to Walch, the scutum is somewhat rectangular, with the anterior margin sinuous, and the posterior margin fairly deep and rounded behind line of PL. The sensillae bases are set close together, behind line of the PL, and the globular sensillae are finely ciliated. PL setae are the longest. The eyes are 2 + 2, with the posterior the smaller. The chelicerae are not serrate. The galeal setae and all the palpal setae are ciliated. Coxae I and II have one seta, III is stated to have 2 setae, but in his figure 8 are shown as having 3 setae. The dorsal setae are 2(0). 8(10). 6.6.6.4.2, to 33μ and the ventral setae posterior of coxae III ca. 32 in number. There is no long nude seta on tarsi III.

Amongst specimens of *kohlsi* and *lanius* from *R. rattus brunneusculus* 17 Dec. 1945 from Imphal was one specimen which on the dimensions and shape of the scutum, the position of the sensillae bases, and the dorsal setae as well as the ciliated galeal setae, bifurcate palpal claw, and all palpal setae being ciliated, is doubtfully referred to Walch's species. Unfortunately the sensillae and scutal setae are missing, and it has 4 setae on each coxa III. This latter feature in other species is known to occasionally vary, but the setae not shown in Walch's figure is that situated at the anterior outer corner of the coxa and generally is somewhat difficult to make out, being confused with the edges of the coxa. It may be that Walch did not see it.

This specimen is the one figured herein, except that in fig. C the sensillae and scutal setae are inserted from Walch's data.

Walch gives the scutum as 43μ long and 64μ wide, and the sensillae as 25μ long with the head 19 by 15μ. The specimen described here has the following Standard Data AW 57·6, PW 73·6, SB 11·2, ASB 22·4, PSB 12·8, SD 35·2, A–P 22·4.

S. (*A.*) *globulare* in the shape of the scutum is closely related to both *lanius* Radford and *kohlsi* Philip and Woodward, but differs from both in having PL the longest of the scutal setae. It differs from *lanius* in the palpal claw being bifid and in the ciliated galeal setae. From *kohlsi* it differs in the multisetose coxae III and the number of dorsal setae.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) KOHLSI (Philip and Woodward 1946).

Neoschöngastia kohlsi Philip and Woodward 1946, Amer. J. Tropical Medicine, 16, (2), 159–161, pl. I, fig. B, D.

Plate 42, fig. C–F.

This species was described from *Rattus mindanensis mindanensis* and *R. vigoratus*, San Jose, Mindoro, Philippines, 1945. It also occurs commonly in Burma, and I have been able to study, through the kindness of Lt.-Col. Audy, a number of specimens from *Rattus rattus brunneusculus* from the neighbourhood of Imphal and collected by Sgt. T. J. Lawrence and other members of the British Scrub-Typhus Research Unit, 1945.

Redescription of Larvae. Shape an elongate oval. Length (engorged) to 510μ, width 405μ. Dorsal scutum as figured, anterior margin sinuous, posterior rather flattened medially, curved laterally and fairly deep behind line of PL; sensillae bases less than their own diameter apart and placed distinctly behind line of PL, A–P ca. 2/3 scutal depth, AM seta the shortest, AL the longest.

Sensillae globose with fine indistinct ciliations. Eyes 2 + 2, the posterior the smaller. Chelicerae not serrate, only furnished with the usual apical tricuspid cap. Galeal setae ciliated. Palpi stout, with bifurcate tibial claw. All setae on palpi ciliated, although sometimes the dorsal and lateral setae of tibia appear nude, palpal tarsi with the usual basal and subapical sensory rods, and 4 or 5 ciliated setae. Dorsal setae very numerous, ca. 86 in number (P. and W. give 52 to 68), and arranged ca. 2.12.14.12.14.10.10.6.4.2, to 40–45μ long, thick with prominent setules. Ventrally, all coxae 1-setose, the usual pair of branched maxillary palpal setae, a pair of ciliated setae between coxae I and between coxae III, and thereafter ca. 60 setae to 25μ long. Legs: I 230μ long, II 210μ, III 230μ; tarsi I and II with the usual dorsal sensory rod, III without any long outstanding nude seta.

The Standard Data, for eleven paratypes statistically treated from the data given by Philip and Woodward are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	52·3±0·65	2·15±0·46	45·9–58·7	48·0–56·0	4·1
PW	63·6±0·58	1·91±0·41	57·9–69·3	60·0–66·0	3·0
SB	9·6±0·28	0·92±0·20	6·8–12·4	8·0–11·0	9·6
ASB	24·3±0·38	1·27±0·27	20·5–28·1	22·0–27·0	5·2
PSB	8·55±0·28	0·93±0·20	5·75–11·35	7·0–10·0	10·9
SD	32·8±0·38	1·25±0·27	29·05–36·55	32·0–35·0	3·8
A–P	19·7±0·33	1·11±0·24	16·4–23·0	18·0–21·0	5·6
AM	22·55±0·92	3·04±0·65	13·4–31·7	20·0–28·0	13·5
AL	45·55±0·46	1·54±0·33	40·9–50·2	42·0–48·0	3·4
PL	34·3±0·75	2·49±0·53	26·8–41·8	32·0–40·0	7·3
Sens.	24·6±1·17	3·69±0·82	13·5–35·7	20·0–30·0	15·0

That the Burma material does not differ significantly in the Standard Data is seen from the following data derived from 9 specimens measured:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	49·95±0·74	2·23±0·53	43·25–56·65	48·0–54·4	4·5
PW	66·65±0·38	1·13±0·27	63·25–70·05	64·0–67·2	1·7
SB	9·6	No variation recorded			
ASB	25·6	No variation recorded			
PSB	12·8	No variation recorded			
SD	38·4	No variation recorded			
A–P	22·4	No variation recorded			
AM	24·5±0·66	1·65±0·48	19·5–29·5	22·4–25·6	6·7
AL	59·7±1·55	3·88±1·12	48·1–71·5	54·4–64·0	6·5
PL	38·3±0·89	2·35±0·63	29·3–43·3	32·0–38·4	6·5
Sens.	28·8 with head 19/19. Only 1 determination.				

Remarks. This species is one of a small group distinguished by the sensillae bases being less than their own diameter apart. It can be separated from the others of the group as in the key.

In the general form of the scutum, it has the sensillae bases behind line of PL; and in having AL the longest of the scutal setae this species is closely related to *lanius* Radford 1946. From this species, however, it is distinct in the much more numerous dorsal setae, in the palpal claw being only bifid, and in having all palpal setae as well as the galeal setae ciliated or branched.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) COMATA sp. n.

Plate 43, fig. A–E.

Description of Larvae: Shape oval. Length (un-engorged) 364μ, width 260μ. Scutum as figured with anterior margin lightly sinuous, posterior margin deeply rounded but rather flattened medially, A–P rather short with PL nearer to AL than to posterior margin, SB very close together and posterior of line of PL, sensillae globose and finely setulose. Eyes 2 + 2, on ocular shields, posterior the smaller and indistinct. Chelicerae simple with only the apical tricuspid cap. Galeal setae strongly branched. Palpi stout, tibial claw bifurcate, setae on palpal femur and genu shortly and strongly ciliated; setae on tibia nude except ventral which has 2 or 3 branches, tarsi with subapical and sub-basal rods and 4 or 5 ciliated setae. Dorsal setae numerous, more than 110, and arranged ca. 2.16.10.12.14.12.14.14.8.6.4, thick and with strong setules, to 28μ long. Ventrally with a pair of ciliated setae on maxillae, a pair between coxae I and between coxae III and thereafter ca. 60 setae finer but almost as long as the dorsal. Legs 7-segmented, I 220μ long, II 182μ long, III 220μ; tarsi I and II with usual dorsal sensory rods, tarsi III without any long nude seta.

The Standard Data for the type and 1 paratype are: AW 59·0, PW 70·0, SB 10·0, ASB 28·0, PSB 12·0, SD 40·0, A–P 20·0, AM 24·0, AL 42·0, PL 31·0, Sens. 30·0 with head 18/18.

Loc. and Host. The type and two paratypes (damaged) from Clarke Field, Philippine Islands. 1945. (G. M. Kohls).

Remarks. In the shape of the scutum with AL setae the longest, and all coxae unisetose, this species is closely related to *S.* (*A.*) *kohlsi* Philip and Woodward. It differs from that species, however, in having much more numerous and shorter dorsal setae. This species also occurs in Kashmir, India, and I have recently been able to study four specimens in all, collected from rats from Kanzalwan, Kashmir, October, 1946, by Major S. L. Kalra.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) LANIUS (Radford 1946).

Neoschöngastia lanius Radford 1946. Proc. Zool. Soc. London, 116, (2), 262, fig. 23–24.

Plates 43, fig. F–H; 44, fig. A.

This species was originally described, but very briefly, from specimens from the Black-headed shrike (*Lanius nasutus* Scopoli) from Imphal, Burma, Feb. 11th, 1945. It has also been taken in fairly large numbers by Sgt. T. J. Lawrence and other members of the British Scrub-typhus Research Unit in Burma, 1945 and onwards. To Lt.-Col. J. A. Audy, I am indebted for the opportunity of studying this material, which was mainly from *Rattus rattus brunneusculus* from an area about 10 to 20 miles north of Imphal. The following redescription and figures are from this material.

Re-description of Larvae. Shape elongate oval. Length (engorged) to 510μ, width to 320μ. Scutum as figured with PL placed about midway of scutal depth, and sensillae well behind line of PL. AM the shortest, AL the longest. Sensillae globose and finely ciliated, bases less than their diameters apart, with strong crescents anteriorly. Eyes 2 + 2, the posterior the smaller, anterior with strongly reflecting cornea. Chelicerae non-serrate, with only the apical tricuspid cap. Galeal setae nude. All palpal setae ciliated. Palpal claw trifid. Dorsal setae 38 in number, arranged 10.6.6.8.4.2.2, to 38μ long. Ventrally, with the usual pair of branched setae on maxillae, one seta on each of coxae I and II, two setae on coxae III (but variable from 2–4), a pair of setae between coxae I and between coxae III, thereafter ca. 28, arranged 6.6.6.2.4.2.2. Legs I 292μ long, II 258μ, III 278μ; tarsi I and II with the usual dorsal rod, III without any long nude seta. The Standard Data from eleven specimens from Imphal are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	57·1±0·77	2·66±0·54	49·1–65·1	51·2–60·8	4·7
PW	70·9±0·77	2·67±0·54	62·9–78·9	67·2–73·6	3·7
SB	9·2±0·21	0·72±0·15	7·0–11·4	8·0–9·6	7·9
ASB	25·6	No variation recorded			
PSB	12·8	No variation recorded			
SD	38·4	No variation recorded			
A-P	17·8±0·42	1·44±0·29	13·5–22·1	16·0–19·2	8·0
AM	32·3±0·52	1·73±0·37	27·1–37·5	28·8–35·2	5·3
AL	56·15±0·66	2·20±0·47	49·55–62·75	54·4–60·8	3·9
PL	45·6±0·42	1·45±0·29	41·3–49·9	44·8–48·0	3·2
Sens.	28·8 with head 16/19. No variation recorded.				

Remarks. This member of the small group of species with closely approximated sensillae bases is closely related to *kohlsi* Philip and Woodward, but differs in the trifurcate palpal claw, the nude galeal setae, the nude lateral and dorsal setae on the palpal tibia, and in the smaller number of dorsal setae. Also A–P is not greater than 1/2 SD. In this it approaches *globulare* Walch, but differs in the trifurcate palpal claw, in coxae III being bisetose, not trisetose, and in AL not PL being the longest. It can be distinguished as in the key.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) MUTABILIS (Gater 1932).

Neoschöngastia mutabilis Gater 1932 Parasitology, 24; Womersley and Heaslip 1943. Tr. Roy. Soc. S. Aust. 67, (1), 111, pl. VII, Fig. 5.

Plate 44, fig. B–E.

This species was described by Gater, but without any figure, from a cluster of mites in the ears of *Rattus sabanus vociferans* (Miller) from Sungei Buloh, Selangor, F.M.S. It does not appear to have been met with since, and the following redescription and figures are from a paratype specimen from Gater from *Tupaia glis ferruginia* in the collections of the South Australian Museum.

Re-description of Larva. Shape an elongate oval. Length (engorged) 430μ, width 285μ. Scutum trapezoidal, with sensillae bases (sensillae missing) in front of line of PL and A–P greater than 3/4 scutal depth; AL setae the longest. Eyes 2 + 2, posterior the smaller. Chelicerae non-serrate, with only the small apical tricuspid cap. Galeal setae nude. Palpal claw trifurcate. Setae on palpal femur and genu with a few short ciliations; on tibia, dorsal and lateral nude or with indistinct ciliations, ventral ciliated. Dorsal setae 40, arranged ca. 2.8.6.6.8.2.4.2.2, to 38μ long, shortly ciliated. Ventrally with the usual pair of branched setae on maxillae, a pair of ciliated setae between coxae I and between coxae III, one such on coxae I and II, and three (variable) on coxae III, behind coxae III with ca. 32 setae. Legs I 240μ, II 185μ, III 220μ; tarsi I and II with the usual dorsal sensory rod, III without any long nude seta.

Standard Data: AW 48·0, PW 62·0, SB 9·0, ASB 26·0, PSB 13·0, SD 39·0, A–P 26·0, AM 29·0, AL 53·0, PL 40·0, Sens. ?.

Remarks. In the shape of the scutum, with A–P greater than 1/2 scutal depth, and sensillae bases in front of line of PL, *mutabilis* is closely related to *signata* sp. n. It differs from the latter species, however, in having AL and not PL the longest, the sensillae being distinctly ciliated, in the number of dorsal setae, and in having coxae III trisetose. It is readily separated as in the key.

The record of Lawrence (in Audy 1947) for this species is incorrect. His material is a mixture of *S.* (*A.*) *lanius* (Radford 1946) and *S.* (*A.*) *kohlsi* (Philip and Woodward 1946).

SCHÖNGASTIA(ASCOSCHÖNGASTIA) EDWARDSI (Gunther 1939).

Neoschöngastia rioi Gunther 1938 (*nom. nud.*) Med. J. Aust., 2, (6), 202.

Neoschöngastia edwardsi Gunther 1939, Proc. Linn. Soc., New South Wales, 64, (1–2), 86; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 112.

Plate 44, fig. F–H.

According to Gunther's original description the palpal claw is bifurcate, the setae on the palpal femur and genu ciliated and on the tibia dorsally and laterally nude, ventrally branched; the galeal setae are nude; the chelicerae simple with only the apical tricuspid cap; and tarsi III is furnished with a long nude seta.

I have now been able to examine the paratype specimen of this species in the Australian Museum, Sydney; it is unfortunately poorly mounted and the details of the palpi and mouthparts cannot be clearly seen. The Standard Data, however, are measurable, and are as follows: AW 76·0, PW 96·0, SB 38·0, ASB 32·0, PSB 29·0, SD 61·0, A–P 29·0, AM 48·0, AL 80·0, PL 72·0, Sens. 28·0 with head 18/29 and finely setulose. These values are somewhat higher than those reported by Womersley and Heaslip (1943) for Gunther's type. The dorsal setae are 2.14.14.10.12.8.4 approx.

In the bifurcate palpal claw this species is close to *philippensis* Philip and Woodward 1946 but differs from it in the presence of a long nude seta on tarsi III, in the shape and dimensions of the dorsal scutum, in AL being longer than PL, and in having many more dorsal setae.

It is still only known from the original material, from the bush fowl, *Megapodius duperreyi* from New Guinea.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) PHILIPPENSIS (Philip and Woodward 1946).

Neoschöngastia philippensis Philip and Woodward 1946, Amer. J. Tropical Medicine, 26, (2), 158.

Plate 45, fig. A–C.

This rather characteristic species was described by Philip and Woodward from specimens from *Rattus mindanensis mindanensis* and *R. vigoratus* from Mindoro, Philippines.

I am much indebted to Lt.-Col. Philip for a number of paratypes (19) and I have also 3 other specimens from the same locality, Feb., 1945 (C. Mohr.). In addition, in the South Aust. Museum collection, is a slide of 4 specimens from New Castle Waters, Queensland, dated 17 May, 1942, from the ears of a wallaby (R. V. Southcott) which can be referred to this species. In addition to the details given in the original description the following may be noted: the palpal claw is bifurcate; the setae on the palpal femur and genu branched, on the tibia dorsally and laterally nude and ventrally branched; chelicerae with only the apical tricuspid cap and galeal setae nude; there is no long nude seta on tarsi III.

The shape of the scutum is rather characteristic, and the Standard Data for 22 specimens from the original material are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	54·6±0·39	1·82±0·27	49·2–60·0	50·0–57·0	3·3
PW	79·2±0·46	2·19±0·33	72·7–85·7	75·0–82·0	2·7
SB	23·0±0·38	1·81±0·27	17·6–28·4	21·0–25·0	7·9
ASB	21·0	No variation recorded			
PSB	12·3±0·26	1·22±0·18	8·7–15·9	11·0–14·0	9·9
SD	33·3±0·26	1·22±0·18	29·7–36·9	32·0–35·0	3·7
A–P	25·0	No variation recorded			
AM	24·5±0·25	1·19±0·18	20·2–28·1	21·0–27·0	4·9
AL	44·7±0·46	2·16±0·32	38·2–51·2	43·0–47·0	4·8
PL	53·1±0·47	2·20±0·33	46·5–59·4	50·0–57·0	4·1
Sens.	29·0 with head 18/18.				

SCHÖNGASTIA (ASCOSCHÖNGASTIA) MACKERRASAE sp. n.

Plate 45, fig. D–I.

Description of Larvae. Shape an elongate oval. Length (unengorged) 365μ, width 220μ. Scutum as figured with well rounded postero-lateral corners, and PL placed very near to AL; sensillae globose and finely setulose with their bases behind line of PL; AL setae the shortest, PL the longest, and all scutal setae strongly dentate but denticles rather shorter and more numerous than on dorsal setae. Eyes 2 + 2, closely adjacent to scutum, posterior the smaller. Palpi stout, femur strongly angulate, with seta long and strongly ciliated; seta on genu much finer with fewer branches; all setae on palpal tibia nude; tibial claw bifurcate; tarsus with 5–6 long ciliated setae. Chelicerae non-serrate, with only the usual apical tricuspid cap. Galeal setae nude. Dorsal setae numerous, ca. 100 to 70–56μ, strong with 5–6 strong denticles, arranged ca. 8.16.18. plus. Ventrally with a pair of branched setae on maxillae, a long fine ciliated seta on each coxa, a pair between coxae I, and 6 between coxae III, the outer ones of which lie close in the angle formed by the peculiar shaped

coxae III with coxae II, thereafter ca. 80–100 setae to 42μ long. Legs all 7-segmented; I 350μ long, II 312μ, III 390μ; tarsi I and II with dorsal sensory rod; III without any long nude setae.

The Standard Data for the unique type are: AW 58·8, PW 75·6, SB 33·6, ASB 25·2, PSB 16·8, SD 42·0, A–P 14·0, AM 53·2, AL 30·8, PL 78·4, Sens. 36·4 with head 19·6/25·2.

Loc. and Host. A single specimen found free living, Bramston's Beach, N. Queensland, Sept., 1949 (M. J. and I. M. Mackerras).

Remarks. This species is striking in the dentate dorsal setae, and shows some relationship to certain members of the *foliata* group. It is named in honour of Mrs. M. J. Mackerras, one of the discoverers.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) MASTA (Traub and Sundermeyer 1950).

Ascoschöngastia masta Traub and Sundermeyer 1950, Proc. Helminth. Soc. Washington, 17, (1), 35–38, fig. 1–4.

Plate 68, fig. A–D.

Description of Larvae (after Traub and Sundermeyer). Shape oval, often with two faint constrictions on abdomen. Length 287μ, width 220μ. Scutum small, wider than long; anterior margin concave but medially sinuate, posterior corners well rounded; PL situated off the scutum, AL the shortest; sensillae globose with sparse strong setules, the bases in midline of scutum; surface fine punctate. Eyes 2 + 2, on ocular shields, posterior the smaller. Chelicerae with only the apical tricuspid cap. Galeal setae short and nude. Palpi stout, tibial claw trifurcate; seta on femur strongly branched, on genu long and nude, on tibia dorsal and ventral branched but lateral not specified or figured. Dorsal setae short, to 25μ long and ciliated, 46 in number, and arranged 2.10.8.10.8.6.2. Ventrally with paired branched setae on maxillae ("galeal" of T. and S.), a pair between coxae I and between coxae III, one on each of coxae I and II, two on coxae III, and thereafter about 36 setae somewhat thinner and shorter than dorsal. Legs: I 220μ, II 170μ, III 190μ; tarsi I and II with dorsal sensory rod (spur), III without any long nude seta.

The Standard Data as given for the type and 3 paratypes are: AW 38·42 (aver. 40), PW 66–74(70), SB 19–24(21), ASB 14–19(17), PSB 13–16(14), SD 27–35(31), A–P 32, AM 28, AL 14, PL 24, Sens. 30–32(31).

Loc. and Host. Described from specimens from *Rattus rattus*, from Myitkyina, North Burma, 29 Nov., 1944, with additional specimens from *Tupaia belangeri* (a tree shrew), 24 Dec., 1944, and a shrew *Crocidura* sp., 2 Feb., 1945, all collected by members of the U.S. Typhus Commission.

Remarks. The authors place this species in the genus *Ascoschöngastia* Ewing in the restricted sense as used by Wharton 1948 and as typified by the genotype *malayensis* Gater. The position and validity of the generic name *Ascoschöngastia* is discussed earlier in this paper.

The position of PL off the dorsal scutum is similar to that of *malayensis*, from which the present species differs in the number of DS, the trifurcate palpal claw, and the bisetose coxae III, as well as the globose instead of lanceolate sensillae.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) PETROGALE (Wom. 1934).

Neoschöngastia petrogale Womersley 1934, Rec. S. Aust. Mus., 5, (2), 215; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust. 67, (1), 111.

Plate 45, fig. J–M.

No further specimens of this rather striking species, which was described from the scrotum of a wallaby collected by Dr. C. J. Hackett in the Musgrave Ranges, South Australia, in July, 1933, have been received.

The palpal claw is trifurcate; the setae on the palpal femur and genu are branched and on the tibia the dorsal and lateral nude, ventral branched. The chelicerae are simple, with only the apical tricuspid cap; and the galeal setae are nude. The globose sensillae are finely but distinctly setulose.

The Standard Data (re-measured) for eleven specimens of the type series are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	73·5±0·67	1·64±0·47	68·6–78·4	72·0–75·0	2·2
PW	98·8±1·22	2·99±0·86	89·8–107·6	97·0–104·0	3·0
SB	34·7±0·84	2·07±0·59	28·5–40·9	32·0–36·0	6·0
ASB	32·0	No variation recorded			
PSB	30·0	No variation recorded			
SD	62·0	No variation recorded			
A–P	36·0	No variation recorded			
AM	41·0±0·63	1·56±0·45	36·3–45·7	40·0–43·0	3·8
AL	49·7±1·05	2·58±1·05	42·0–57·4	47·0–54·0	5·2
PL	55·0±0·63	1·56±0·45	50·3–59·7	54·0–57·0	2·8
Sens.	32·0 with head 17/17.				

SCHÖNGASTIA (ASCOSCHÖNGASTIA) MOHRI sp. n.

Plate 46, fig. A–C.

Description of Larvae. Shape broadly oval. Length (engorged) to 450μ, width to 360μ. Scutum rectangular, with PL setae placed on the sides, relatively near to AL and not at the broadly rounded postero-lateral angles; scutum widest behind line of PL; posterior scutal margin lightly sinuous; sensillae

bases behind line of PL and about in mid-line of scutum. Eyes 2 + 2, apparently not on ocular shields, posterior the smaller. Chelicerae simple, with only the apical tricuspid cap. Galeal setae nude. Palpi stout, tibial claw trifurcate; all setae on femur, genu and tibia branched. Dorsal setae ca. 44 in number, to 65μ long and arranged 2.10.10.10.6.4.2. Dorsal cuticular striations markedly crenulate (in good fresh mounts) as in following species. Ventrally with a pair of branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 60 setae to 36μ long. Legs I 330μ long, II 300μ, III 320μ; tarsi I and II with the usual dorsal sensory rod; tarsi III without any long nude seta.

The Standard Data for the type and 5 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	74·2±1·19	2·93±0·85	65·4–83·0	69·0–77·0	3·9
PS	87·0±1·17	2·89±0·83	78·3–95·7	83·0–91·0	3·3
SB	28·3±0·49	1·21±0·35	24·7–31·9	27·0–30·0	4·2
ASB	29·2±0·54	1·33±0·38	25·2–33·2	27·0–30·0	4·5
PSB	30·0	No variation recorded			
SD	59·2±0·54	1·33±0·38	55·2–63·2	57·0–60·0	2·2
A–P	21·8±0·48	1·17±0·34	18·0–25·3	21·0–24·0	5·4
AM	56·4±0·40	0·89±0·28	53·7–59·1	56·0–58·0	1·6
AL	46·0±1·11	2·49±0·79	38·5–53·5	42·0–48·0	5·4
PL	78·0±0·95	2·12±0·67	71·7–84·3	75·0–80·0	2·7
Sens.	36·0 with head 16/18. Only 1 determination.				

Loc. and Hosts. The type and 5 paratypes from *Echymipera doreyana* from Sansapor, Dutch New Guinea, 16 Nov., 1944 (C. Mohr.); another specimen from same locality on *Rattus concolor* 19 Nov., 1944 (C.M.).

Remarks: In the general form of the scutum with short A–P and the crenulate dorsal striations this species is closely related to the following, *S.* (*A.*) *crinita* sp. n. from which it differs as in the key. In the type, the sensillae which have become detached show an involucrum-like structure at the base of the stem.

It is a pleasure to name this species after the finder, Dr. C. Mohr, from whom much interesting material was received.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) CRINITA sp. n.

Plate 46, fig. D–G.

Description of Larvae. Shape oval. Length (unfed) 285μ, width 185μ. Dorsal scutum as figured, very much as in *mohri*, but with PL much closer to AL, and with the expansion behind PL greater; finely punctate. Sensillae missing in all specimens; the bases well behind line of PL. Chelicerae non-

serrate, with the usual apical tricuspid cap. Galeal setae nude. Eyes 2 + 2, on ocular shields; posterior the smaller. Palpi stout, with trifurcate tibial claw; all setae on palpal femur, genu and tibia ciliated or branched. Dorsal setae more than 100, arranged ca. 2.14.12.16.12.12.12.10.8.6.4, rather stouter and not so tapering as in *mohri*, with shorter ciliations, to 60μ long. Dorsal cuticle with crenulate striations. Ventrally with a pair of branched setae on gnathosoma, one on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 100 to 20μ long. Legs I 300μ long, II 270μ, III 300μ, tarsi I and II with the usual dorsal sensory rod, III without any long nude seta.

The Standard Data for the type and 2 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	83·7±2·03	3·51±1·43	73·2–94·2	80·0–87·0	4·2
PW	92·3±2·33	4·04±1·65	80·2–104·4	90·0–97·0	4·3
SB	30·7±0·67	1·15±0·47	27·2–34·2	30·0–32·0	3·7
ASB	33·3±1·33	2·31±0·94	26·4–40·2	32·0–36·0	7·0
PSB	30·0	No variation recorded			
SD	63·3±1·33	2·31±0·94	56·4–70·2	62·0–66·0	3·6
A–P	17·0±1·00	1·73±0·71	11·8–22·2	15·0–18·0	10·2
AM	54·0	One determination only.			
AL	45·7±1·33	2·31±0·94	38·8–52·6	43·0–47·0	5·0
PL	90·0	No variation recorded			
Sens.	Missing in all specimens.				

Loc. Described from 3 specimens from *Echymipera doreyana* from Sansapor, Dutch New Guinea, 1945 (W. D. Fitzwater).

Remarks. Very close to the preceding species in the crenulate dorsal striations and the dorsal scutum. Differs in the much greater number of DS and the shorter distance between AL and PL, as well as in the scutal width behind PL being somewhat greater.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) RECTANGULARE sp. n.

Plate 46, fig. H–L.

Description of Larvae. Shape oval. Length (only slightly engorged) 375μ width 240μ. Dorsal scutum as figured with PW only slightly greater than AW, i.e. almost rectangular with lateral margins parallel or almost so; sensillae bases wide apart and about midway between line of AL, and line of PL, and also nearer to lateral margins than to one another; AL much longer than AM or PL and placed well back from antero-lateral corners; sensillae with large globose heads with distinct setules; surface of scutum punctate and

the posterior half overlapped by the dorsal cuticular striations. Eyes 2 + 2, large, on distinct ocular shields and the posterior eye the smaller. Chelicerae not serrate, only furnished with the usual apical tricuspid cap. Galeal setae nude. Palpi stout, tibial claw trifurcate; setae on femur and genu branched, on tibia dorsal and lateral nude, ventral branched. Dorsal setae 36, to 60μ long and arranged 2.8.6.8.6.4.2, slender and finely ciliated. Ventrally on maxillae with a pair of branched setae, a single seta on each coxa, a pair between coxae I and between coxae III, and thereafter 6.6.4.4.2, to 45μ long. Legs I 390μ long, II 360μ, and III 390μ; tarsi I and II with usual dorsal sensory rod; tarsi III with a long nude seta.

The Standard Data from the type and 4 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	76·2±0·56	1·25±0·39	72·4–80·0	75·6–78·4	1·6
PW	81·8±1·05	2·34±0·74	74·8–88·8	78·4–84·0	2·8
SB	47·0±0·56	1·25±0·39	43·2–50·8	44·8–47·6	2·7
ASB	28·0	No variation recorded			
PSB	31·9±0·28	0·62±0·20	30·0–33·8	30·8–32·2	2·0
SD	59·9±0·28	0·62±0·20	58·0–61·8	58·8–60·2	1·0
A–P	30·8	No variation recorded			
AM	54·0±2·00	4·00±1·41	42·0–66·0	48·0–56·0	7·4
AL	82·9±1·42	3·18±1·00	73·4–92·4	78·4–86·8	3·8
PL	58·2±1·05	2·34±0·74	51·2–65·2	56·0–61·6	4·0
Sens.	39·2 with head 22·4/22·4. No variation recorded.				

Loc. The type and 4 paratypes from Lake Eacham, N. Queensland, Dec., 1944 (R. N. McCulloch).

SCHÖNGASTIA (ASCOSCHÖNGASTIA) CASSIOPE sp. n.

Plates 47, fig. E–F; 48, fig. A–B.

Description of Larvae. Shape oval. Length (unfed) 240μ, width 170μ. Dorsal scutum as figured, with both anterior and posterior margins sinuous, AM short, PL the longest; sensillae globose and finely setulose, with bases very slightly in front of line of PL. Eyes 2 + 2, fairly large, on distinct ocular shields, posterior eye the smaller. Chelicerae non-serrate, with only the apical tricuspid cap. Galeal setae nude. Palpi stout, seta on femur with 4–5 branches, on genu with 3–4 branches, all on tibia nude; palpal claw trifurcate. Dorsal setae long, thick and strongly ciliated, 32 in number, and arranged 2.6.6.6.6.4.2, to 56μ long. Ventrally with a pair of branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, and

thereafter ca. 22, shorter and finer than dorsal setae. Legs all 7-segmented, I 240μ long, II 210μ, III 280μ; tarsi I and II with usual dorsal sensory rod, III without any long nude seta.

The Standard Data for the type and two paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	60·7±0·93	1·62±0·66	55·9–65·5	58·8–61·6	2·6
PW	72·8±1·62	2·80±1·14	64·4–81·2	70·0–75·6	3·8
SB	19·6	No variation recorded			
ASB	25·2	No variation recorded			
PSB	16·8	No variation recorded			
SD	42·0	No variation recorded			
A–P	23·3±0·93	1·62±0·66	18·5–28·1	22·4–25·2	6·5
AM	40·0 ca.	No variation recorded			
AL	71·9±3·61	6·35±2·59	57·9–85·9	64·4–75·6	8·8
PL	79·3±4·66	8·08±3·30	55·1–103·5	70·0–84·0	10·2
Sens.	30·8 with head 19·6/19·6. No variation recorded.				

Loc. The type on boots, Wandeela, N. Queensland, 2 Oct., 1944 (R. N. McCulloch) and two paratypes, Wongabel, N.Q., Dec., 1944 (R. N. McC.)

Remarks. The relationship of this species is best seen from the key.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) ANTIPODIANUM (Hirst 1929).

Schöngastia antipodianum Hirst 1929, Proc. Zool. Soc. London, (1), 175.

Neoschöngastia antipodianum, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 114.

Plate 47, fig. A–D.

No fresh material of this species has been seen since the original discovery. It was found in the ears of *Rattus greyi* from D'Estree Bay, Kangaroo Island, South Australia and the co-type material is in the collection of the South Australian Museum.

The palpal tibial claw is trifurcate and all the setae on the palpal femur, genu and tibia are branched or ciliated. The chelicerae are non-serrate with only the apical tricuspid cap. The galeal setae are nude.

The dorsal scutum is almost rectangular, with AW only slightly shorter than PW, and the lateral margins subparallel; AL are slightly longer than PL and placed in the antero-lateral corners; sensillae globose, indistinctly setulose and their bases somewhat nearer line of PL than line of AL. Eyes large, on distinct ocular shields, the posterior eyes the smaller.

The Standard Data as redetermined from 7 specimens of the co-type material are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	60·8±0·31	0·81±0·22	58·4–63·2	59·8–61·6	1·3
PW	69·6±0·95	2·52±0·67	62·1–77·1	67·2–72·8	3·6
SB	25·2	No variation recorded			
ASB	28·8±0·52	1·37±0·36	24·7–32·9	28·0–30·8	4·7
PSB	19·6	No variation recorded			
SD	48·4±0·52	1·37±0·36	44·3–52·5	47·6–50·4	2·8
A–P	39·2±0·61	1·63±0·43	34·4–44·0	36·4–42·0	2·7
AM	38·2±0·60	1·34±0·42	34·2–42·0	36·4–39·2	3·5
AL	67·8±1·05	2·34±0·74	60·8–74·8	64·4–70·0	3·4
PL	59·9±1·42	3·19±1·01	50·3–69·5	56·0–64·4	5·3
Sens.	28·0 with head 22·4/22·4. No variation recorded.				

SCHÖNGASTIA (ASCOSCHÖNGASTIA) DUMOSA sp. n.

Plate 48, fig. C–F.

Description of Larva. Shape oval. Length (unfed) 300μ, width 210μ. Dorsal scutum as figured, with anterior margin convex, and posterior margin somewhat angular; sensillae bases in front of line of PL and surrounded by strongly defined crests; PL the longest, AL the shortest; sensillae globose and strongly setulose. Eyes fairly large, 2 + 2, on ocular shields, and the posterior only a little smaller than anterior. Chelicerae simple, with only the apical tricuspid cap. Galeal setae nude. Palpi stout, tibial claw trifurcate; setae on palpal femur and genu strongly branched; on tibia, dorsal and lateral nude, ventral branched. Dorsal setae strong and strongly ciliated or serrate, ca. 52 in number and arranged 2.10.10.10.8.6.4.2 to 30μ long. Ventrally a pair of branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 3 rows of 10, plus 8.6.4, to 20μ long and posteriorly gradually approaching dorsal setae in form. The striations of the dorsal cuticle very finely crenulate. Legs I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data are: AW 58·8, PW 75·6, SB 22·4, ASB 22·4, PSB 22·4, SD 44·8, A–P 25·2, AM 45·0 AL 33·6, PL 56·0. Sens. 36·4 with head 19·6/19·6.

Loc. The type only, from Atherton, Queensland, on boots, April 5, 1944 (R. N. McCulloch).

Remarks. The unique type slide in the S.A. Mus. collection was regrettably badly damaged while under oil immersion.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) QUEENSLANDICA (Womersley 1939).

Neoschöngastia queenslandica Womersley 1939, Tr. Roy. Soc. S. Aust., 63, (2), 162; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 112.

Plate 48, fig. G–K.

The Standard Data for 10 of the 12 specimens recorded in 1943, as re-measured are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	57·9±0·74	2·33±0·52	50·9–64·9	54·0–61·0	4·0
PW	90·7±0·84	2·62±0·59	82·8–98·6	87·0–97·0	2·9
SB	29·8±0·53	1·69±0·38	24·8–34·8	27·0–32·0	5·6
ASB	31·6±0·27	0·84±0·19	29·1–34·1	30·0–32·0	2·7
PSB	18·8±0·33	1·03±0·23	15·7–21·9	18·0–20·0	5·5
SD	50·4±0·50	1·58±0·35	45·7–55·1	48·0–52·0	3·1
A–P	42·8±0·85	2·70±0·60	34·7–50·9	39·0–47·0	6·3
AM	39·4±0·43	1·35±0·30	35·4–43·4	36·0–40·0	3·4
AL	70·85±1·16	3·08±0·82	61·6–80·1	65·0–75·0	4·3
PL	67·1±0·67	1·88±0·47	61·5–72·7	65·0–70·0	2·8
Sens.	40·0 with head 20/21.				

I have recently seen 5 more specimens collected by Major R. N. McCulloch on boots: Cairns, Queensland, 3 spec. July, 1943; Skull Pocket, Qld., 1 spec. June, 1943, and Atherton, Qld., 1 spec. Sept., 1944. Also numerous specimens from the ears of a euro, near the Daly River, Northern Territory of Australia, 5 June, 1943 (R. V. Southcott, coll. A.C.B. 162).

The species is characterized from its allies by having 4 setae in the first dorsal row, i.e. two submedial as well as the two scapular setae. The posterior margin of the scutum is very shallow behind PL, being almost rectilinear. The AL and PL setae are long, with AL slightly the longer. Chelicerae are simple with only the usual apical tricuspid cap. Galeal setae nude. Palpi stout, with trifurcate tibial claw; setae on femur and genu branched; on tibia, dorsal and lateral nude, ventral branched. Dorsal setae 4.6.6.6.2.2, to 50μ long. Ventral setae, posterior of coxae III 8.6.6.4.4.2, to 21μ long. Sensillae globose and finely setulose.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) LAPPACEA n. nov.

Neoschöngastia melomys Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 110 (in part).

Plate 49, fig. A–D.

On critical re-examination of the type of *N. melomys* from *Melomys littoralis* from Innisfail, Queensland, it was found to be con-specific with *innisfail-*

ensis Wom. and Heasp. 1943 (Tr. Roy. Soc. S. Aust., 67, (1), 108) but not with the series of 15 specimens from rats at Cairns, Queensland, and recorded as *melomys* (*loc. cit.*).

The name *melomys* thus becomes a homonym and invalid and the material from Cairns is herewith redescribed under the name of *lappacea*.

Description of Larvae. Shape oval with sides rather flattened. Length (engorged) 465μ, width 260μ. Dorsal scutum as figured, anterior margin lightly sinuous, posterior margin more or less evenly rounded but slightly flattened or concave medially, and fairly deep behind line of PL; sensillae globose with fine indistinct ciliations, the sensillae bases anterior of line of PL; PL the longest and longer than PW. Eyes 2 + 2, rather small, posterior the smaller. Chelicerae simple, with only the apical tricuspid cap. Galeal setae nude. Palpi stout with trifurcate tibial claw; setae on femur and genu branched, setae on tibia nude except the ventral sometimes with a medial branch. Dorsal setae 32 in number to 75μ long, rather strong with strong setules, arranged 2.6.6.6.6.4.2. Ventrally with a pair of branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter 4.6.6.6.4.4, to 30–45μ long. Legs I 220μ, II 190μ, III 220μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for the type and 9 specimens from rats, Cairns, Qld. 1939–40 (W.G.H.), 8 specimens from the ears of a euro, at Daly River, Northern Territory, Aust. (R. V. Southcott), and 2 specimens from boots from Skull Pocket, Kairi, Qld., July 1943 (R. N. McCulloch), are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	54·0±0·45	2·00±0·32	48·0–60·0	50·4–56·0	3·7
PW	70·4±0·53	2·39±0·38	63·3–77·5	64·4–72·8	3·4
SB	19·6±0·28	1·25±0·20	15·8–23·4	16·8–22·4	6·4
ASB	25·2	No variation recorded			
PSB	19·6	No variation recorded			
SD	44·8	No variation recorded			
A–P	27·8±0·27	1·19±0·19	24·2–31·4	25·2–29·4	4·3
AM	31·6±0·69	3·08±0·49	22·4–40·8	28·0–39·2	9·7
AL	70·4±0·36	1·60±0·25	65·6–75·2	67·2–72·8	2·3
PL	80·9±0·81	3·64±0·57	70·0–91·8	75·6–86·8	4·5
Sens.	33·6 with head 16·8/19·6. No variation recorded.				

SCHÖNGASTIA (ASCOSCHÖNGASTIA) WOMERSLEYI (Gunther 1940).

Neoschöngastia womersleyi Gunther 1940, Proc. Linn. Soc. New South Wales, 65, (3–4), 254; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 109.

Plates 49, fig. E–G; 50, fig. A.

Of this species I have another specimen collected from a rat (No. 9) by Maj. G. M. Kohls in New Guinea, 15th Nov., 1943.

The Standard Data as remeasured for 7 of Gunther's paratypes in the South Australian Museum collection, and the additional specimen referred to above are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	47·95±0·63	1·79±0·45	42·55–53·25	44·8–50·4	3·7
PW	68·95±1·05	2·97±0·74	60·05–77·85	67·2–75·6	4·3
SB	19·25±0·35	0·99±0·25	16·25–22·25	16·8–19·6	5·1
ASB	28·0	No variation recorded			
PSB	18·9±0·46	1·29±0·32	15·0–22·8	16·8–19·6	6·8
SD	46·9±0·46	1·29±0·32	43·0–50·8	44·8–47·6	2·8
A–P	31·5±0·46	1·29±0·32	27·6–35·4	30·8–33·6	4·1
AM	39·2±0·61	1·62±0·43	34·3–44·1	36·4–42·0	4·1
AL	84·0	No variation recorded			
PL	134·6±1·78	4·72±1·26	120·4–148·8	126·0–140·0	3·5
Sens.	33·6 with head 16·8/19·6. Only 1 determination.				

This is a very remarkable species in the excessively long PL setae which are about twice the length of PW. The scutum is as figured with the posterior margin relatively shallow behind PL. The sensillae are globose with fine setules, and their bases nearer to one another than to the lateral scutal margins and only slightly in front of line PL. The chelicerae are not serrate and have only the usual apical tricuspid cap. The galeal setae are nude. The palpal tibial claw is trifurcate and the setae on the femur and genu branched, on the tibial only the ventral seta with branches. The dorsal setae are strongly ciliated, to 75μ long, and 28 in number arranged 2.6.6.6.4.2.2.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) COORONGENSE (Hirst 1929).

Schöngastia coorongense Hirst 1929, Ann. Mag. Nat. Hist., (10), 3, 564.

Neoschöngastia coorongense, Wom. and Heasp. 1943, Tr. Roy. Soc. S. Aust., 67, (1), 114.

Plate 50, fig. B–E.

This species, the original description of which was unaccompanied by any figure, is still only known from the original material from the ears of a rat from Robe, S. Australia. The co-types are in the South Australian Museum.

The palpal claw is trifurcate; the seta on the palpal femur has many

rather short branches, on the genu somewhat fewer short branches and all 3 setae on the tibia are nude. The chelicerae are simple and armed only with the usual apical tricuspid cap. The galeal setae are nude. The dorsal scutum is as figured with the setae relatively slender and finely ciliated and PL the longest, AL the shortest; the sensillae are capitate, strongly setulose, and with their bases surrounded with strong chitinous lines and placed slightly in front of line of PL. The dorsal setae are fairly slender, shortly ciliated, 32 in number, to 45μ long and arranged 2.6.6.6.6.4.2. The ventral setae behind coxae III are ca. 8.8.8. to 25μ long, then 6.6.4.2. to 40μ long. There is no long nude seta on tarsi III.

The Standard Data for 15 co-types as remeasured are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	70·9±0·93	3·60±0·66	60·1–81·7	67·2–78·4	1·8
PW	95·95±1·50	5·82±1·06	78·5–113·4	86·8–109·2	6·1
SB	32·8±0·67	2·60±0·47	25·0–39·8	28·0–39·2	7·9
ASB	30·8±0·37	1·45±0·26	26·5–35·1	28·0–33·6	4·7
PSB	22·4	No variation recorded			
SD	53·2±0·37	1·45±0·26	48·9–57·5	50·4–56·0	2·7
A–P	34·5±0·51	1·96±0·36	28·6–40·4	33·6–39·2	3·5
AM	49·1±0·45	1·73±0·32	43·9–54·3	44·8–50·4	3·5
AL	42·0±0·46	1·77±0·32	36·7–47·3	39·2–44·8	4·2
PL	64·4±0·95	3·68±0·67	53·4–75·4	56·0–70·0	5·7
Sens.	33·6 with head 19·6/19·6. No variation recorded.				

Two specimens were recently taken along with one *S.* (*A.*) *dasycerci* (Hirst) from *Rattus murrayi* var. on Greenly Is., South Australia, Dec., 1947 (F. J. Mitchell).

SCHÖNGASTIA (ASCOSCHÖNGASTIA) ECHYMIPERA (Wom. and Kohls 1947).

Ascoschöngastia echymipera Womersley and Kohls 1947, Tr. Roy. Soc. S. Aust. 71, (1), 11–12.

Plates 50, fig. F–I; 51, fig. A.

This species was described from specimens collected from a bandicoot, *Echymipera cockerelli* from Dobodura, New Guinea, Nov. 1943 (G. M. Kohls). In the key it comes close to *innisfailensis* Wom. and Heasp. 1943, but can be distinguished therefrom by the posterior scutal margin being very shallow, almost rectilinear between PL, and by the rather greater number of dorsal setae.

The Standard Data as given by Womersley and Kohls are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	45·3±0·29	1·16±0·20	41·8–48·8	43·0–48·0	2·5
PW	61·5±0·53	2·12±0·37	55·1–67·9	57·0–66·0	3·4
SB	20·4±0·39	1·17±0·21	16·9–23·9	18·0–21·0	5·7
ASB	21·0	No variation recorded			
PSB	15·0	No variation recorded			
SD	36·0	No variation recorded			
A–P	31·3±0·37	1·49±0·26	26·8–35·8	30·0–33·0	4·7
AM	26·6±0·36	1·45±0·26	22·2–31·0	24·0–30·0	5·6
AL	46·5±0·59	2·37±0·42	39·4–53·6	42·0–51·0	5·1
PL	42·6±0·36	1·45±0·26	38·2–47·0	40·0–45·0	3·4
Sens.	27·0 with head 17/17. No variation recorded.				

SCHÖNGASTIA (ASCOSCHÖNGASTIA) INNISFAILENSIS (Wom. and Heaslip 1943).

Neoschöngastia innisfailensis Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 108.

Neoschöngastia melomys Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 110 (in part).

Ascoschöngastia bushlandi Philip 1947, J. Parasitology, 33, (3), 387.

Plate 51, fig. B–E.

Re-examination of the type specimen of *Neoschöngastia melomys* Wom. and Heasp., from Innisfail, Queensland, shows it to be co-specific with *innisfailensis*, but not so with the rest of the material from Cairns, and recorded as *melomys* (see under *S.* (*Ascoschöngastia*) *lappacea*, n. nov.).

Re-description of Larvae. Shape elliptical. Length (engorged) to 450μ, width to 320μ. Dorsal scutum as figured, with AL the longest but only slightly longer than PL; anterior margin sinuous and convex medially; sensillae globose, appearing nude, but under high magnification with indistinct setules which are most obvious near the base of head; sensillae bases nearer to one another than to lateral margins and practically in line with PL. Eyes 2 + 2, on ocular shields, the posterior the smaller. Chelicerae non-serrate, with only the apical tricuspid cap. Galeal setae nude. Palpi stout with trifurcate tibial claw; setae on femur and genu branched, on tibia all 3 nude. Dorsal setae tapering and with fairly strong setules, to 45μ long and arranged 2.6.6.6.6.4.2. Ventrally with a pair of branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 38–40, to 35μ long. Legs I 270μ long, II 225μ, III 300μ; tarsi I and II with the usual dorsal sensory rod. III without any long nude seta.

The Standard Data from twelve of the original specimens from Innisfail, Queensland, from *Melomys littoralis* are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	47·8±0·88	3·03±0·62	38·7–56·9	44·8–56·0	6·3
PW	72·1±1·15	3·98±0·81	60·2–84·0	67·2–78·4	5·5
SB	21·5±0·44	1·52±0·31	17·0–26·0	19·6–23·8	7·0
ASB	28·0	No variation recorded			
PSB	19·6	No variation recorded			
SD	47·6	No variation recorded			
A–P	27·9±0·27	0·93±0·19	25·1–30·7	25·2–29·4	3·3
AM	28·55±0·37	1·18±0·26	25·0–32·1	28·0–30·8	4·1
AL	54·9±0·48	1·44±0·32	50·6–59·2	53·2–56·0	2·6
PL	47·6±0·49	1·69±0·34	42·6–52·6	44·2–50·4	3·5
Sens.	35·0 with head 20/21.				

Recently Philip (*loc. cit.*) has described from Owi Is., D.N.G., a new species under the name of *Ascoschöngastia bushlandi*. In his discussion Philip points out the close relationship to *innisfailensis*, the main differences being in the somewhat larger size of the dorsal scutum, the longer ciliations on the scutal setae, and the presence of an involucrum at the base of the stem of the detached sensillae. This peculiar structure has not been described before, and is probably to be found in many species but obscured by the structure of the sensillary cup unless the sensillae become detached. I have since seen the same structure in *S.* (*A.*) *mohri* sp. n. as mentioned under that species, and it also occurs in *innisfailensis*.

In other morphological details *bushlandi* cannot be separated from *innisfailensis*, and on the slightly larger scutum, particularly PW, it should probably be regarded as not more than a geographical race. I am greatly indebted to Dr. Philip for the original data of 28 specimens for which he gives the Standard Data in terms of observed range and mean in his paper. Treated more fully for comparison with that of *innisfailensis* the Standard Data for *bushlandi* is as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	51·7±0·37	1·97±0·26	45·8–57·6	47·8–55·1	3·8
PW	81·3±0·72	3·83±0·51	69·8–92·8	70·3–89·9	4·7
SB	21·4±0·35	1·84±0·25	15·9–26·9	15·2–26·7	8·6
ASB	25·0±0·27	1·43±0·19	20·7–29·3	22·4–27·5	5·7
PSB	21·9±0·28	1·49±0·20	17·5–26·3	18·2–24·6	6·8
SD	47·0±0·45	2·39±0·32	39·9–54·1	41·4–51·6	5·1
A–P	28·8±0·18	0·94±0·12	26·0–31·6	27·0–31·0	3·3
AM	30·4±0·46	2·31±0·32	23·5–37·3	26·1–35·2	7·6
AL	60·2±0·94	4·42±0·67	47·0–73·2	46·0–68·1	7·3
PL	56·3±0·48	2·41±0·34	49·1–63·5	53·2–60·9	4·3
Sens.	31·4±0·52	1·88±0·37	25·8–37·0	27·5–34·8	6·0

In general *bushlandi* has AW slightly larger than in *innisfailensis*, PW definitely larger, and AL and PL also longer.

In addition to the typical material from Innisfail, for which Standard Data are given above, there are 4 specimens in the South Australian Museum, which agree more with *bushlandi* than *innisfailensis*, in AW and PW, but which have PSB, SD and A–P still greater.

Of these one specimen was collected by W. D. Smith in Oct., 1938, and three by W. G. Heaslip in 1940, all from the type locality and same host as typical *innisfailensis*. Their Standard Data are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	51·1±0·70	1·40±0·49	46·9–55·3	50·4–53·2	2·7
PW	83·3±1·76	3·52±1·24	72·8–93·8	78·4–86·8	4·2
SB	24·5±0·70	1·40±0·49	20·3–28·7	22·4–25·2	5·7
ASB	30·8	No variation recorded			
PSB	25·2	No variation recorded			
SD	56·0	No variation recorded			
A–P	36·4	No variation recorded			
AM	30·8±1·61	3·23±1·14	21·1–40·5	28·0–33·6	10·5
AL	58·8	No variation recorded			
PL	54·6±0·81	1·61±0·57	49·8–59·4	53·2–56·0	3·0
Sens.	Missing.				

More recently a small collection, of 14 specimens, of unfed larvae of this species, from the Bramston's Beach area, N.Q., about 60 miles south of Cairns, and 14 miles north of Innisfail (coll. I. M. and M. J. Mackerras, Sept., 1949) has been studied.

The Standard Data of this series are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	46·1±0·52	1·94±0·37	40·3–51·9	43·4–50·4	4·2
PW	63·6±1·03	3·87±0·73	52·0–75·2	58·8–70·0	6·1
SB	19·2±0·52	1·94±0·37	13·4–25·0	16·8–22·4	10·0
ASB	23·8±0·57	2·15±0·41	17·35–30·25	19·6–28·0	9·0
PSB	18·0±0·48	1·81±0·34	12·6–23·4	16·8–22·4	10·0
SD	41·8±0·46	1·72±0·33	36·6–47·0	39·2–44·8	4·1
A–P	26·8±0·81	3·05±0·58	17·7–35·9	22·4–30·8	11·4
AM	37·2±0·62	2·31±0·44	30·3–44·1	33·6–42·0	6·2
AL	58·8±0·51	1·90±0·36	53·1–64·5	56·0–61·6	3·2
PL	50·4±0·75	2·11±0·53	44·1–56·7	47·6–53·2	4·2
Sens.	31·9±0·39	1·42±0·28	27·7–36·1	30·8–33·6	4·4

This population is significantly different from the original population, in all the Standard Data except AW and A–P, being lower in PW, SB, ASB, PSB, and SD, and Sen. and higher in AM, AL, and PL. The data for PL is based on 5 specimens only, as in one of these 5, only one PL was of normal length, the other measuring 70μ. In 4 other specimens both PL setae measured 70μ.

The population of f. *bushlandi* Philip from the Philippines, differs from the original population significantly in all Standard Data except SB and SD, being greater in AW, PW, PSB, AM and AL, and smaller in ASB, PL, and Sens.

This species, then, seems to be very variable in Standard Data, as seen in populations from different localities.

B. SENSILLAE CLAVATE, SOMETIMES BROADLY SO, OR LANCEOLATE WITHOUT A BASAL STEM.

a. *Sensillae lanceolate without a basal stem.*

SCHÖNGASTIA (ASCOSCHÖNGASTIA) LACUNOSA (Gater 1932).

Neoschöngastia lacunosa Gater 1932, Parasitology, 24; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 110.

Plate 51, fig. F–I.

Dorsal scutum as figured, with posterior margin shallow behind line of PL and almost rectilinear; sensillae somewhat lanceolate with fine setules, their bases wide apart and nearer to line of PL than to line of AL; AM the longest, PL the shortest. Palpal claw bifurcate, setae on femur and genu nude or with a few indistinct barbs, on tibia all 3 nude or with short indistinct barbs. Chelicerae with only the usual apical tricuspid cap. Galeal setae nude. Dorsal setae to 54μ long, short setulations basally, longer distally, 36 in number and arranged 2.6.8.8.6.4.2. No long nude setae on tarsi III.

The Standard Data for 4 paratypes in the British Museum (N.H.) and measured by me during a visit to London in 1947, together with the two in the South Australian Museum and reported by Womersley and Heaslip 1943 are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	64·0±1·20	2·95±0·85	55·2–72·8	59·4–66·5	4·6
PW	75·2±0·81	1·98±0·57	69·3–81·1	72·6–78·0	2·6
SB	37·3±0·27	0·67±0·19	35·3–39·3	36·0–38·0	1·8
ASB	30·7±0·43	1·07±0·31	27·5–33·9	28·6–31·5	3·5
PSB	24·0±0·74	1·64±0·53	19·1–28·9	22·0–26·4	6·8
SD	54·45±1·07	2·40±0·76	47·25–61·65	50·6–57·2	4·4
A–P	44·0±0·48	1·17±0·34	40·5–47·5	43·0–46·2	2·6
AM	44·95±0·47	1·15±0·33	41·5–48·4	44·0–46·5	2·6
AL	35·5±0·38	0·93±0·27	32·7–38·3	35·0–37·4	2·6
PL	26·5±0·48	1·18±0·34	23·0–30·0	25·0–28·6	4·4
Sens.	54·0 with head 6·7 wide.				

Amongst the material in Lawrence's "Type box" of slides in the London School of Tropical Hygiene and Medicine, which I have been permitted to study by Lt.-Col. J. R. Audy, are 4 slides Nos. (37–40) labelled "*Ascoschöngastia* n. sp. 'C', Lawrence in m.s." and referred to as such in Appendix 7, to War Office Report, AMD 7, March 7, 1947.

Lawrence (*loc. cit.*) records these specimens as 3 from the type host, a tree shrew *Tupaia belangeri belangeri* Wagner, and 2 specimens only from *Hydromys humei*. The locality was Palel, Tamu Rd., 30 miles south of Imphal, Manipur State, India, Nov. 24th, 1945.

The four of the above specimens which I have been able to examine do not differ in any morphological features from the Malayan specimens except that they are consistently and significantly larger in all details of the Standard Data, as given below, suggesting that the Imphal material may be regarded as a geographical race of the Malayan species.

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	68·0±0·80	1·60±0·56	63·2–72·8	67·2–70·4	2·3
PW	86·0±3·09	6·18±2·18	67·5–104·5	80·0–92·8	7·2
SB	38·4	No variation recorded			
ASB	35·2±1·31	2·61±0·92	27·4–43·0	32·0–38·4	7·5
PSB	22·4	No variation recorded			
SD	57·6±1·31	2·61±0·92	49·8–65·4	54·4–60·8	4·5
A–P	44·8±1·31	2·61±0·92	37·0–52·6	41·6–48·0	5·8
AM	34·4±0·80	1·60±0·56	29·6–39·2	32·0–35·2	4·7
AL	35·2	No variation recorded			
PL	36·0±0·80	1·60±0·56	31·2–40·8	35·2–38·4	4·4
Sens.	Missing.				

In addition to the differences in Standard Data there is a slight, but probably quite unimportant difference in that in the Imphal specimens PL is about equal in length to AL instead of being distinctly shorter.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) MALAYENSIS (Gater 1932).

Neoschöngastia malayensis Gater 1932, Parasitology, 24; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 110.

Plate 51, fig. J–K.

This species was originally described from specimens from *Rattus malaisia* Kloss from Sungei Buloh, Selangor, F.M.S. Recently Audy and his colleagues have found it at Kepong, Forest Reserve, Selangor, F.M.S. 1950, on *R. sabanus* and *R. whiteheadi* and reared the engorged larvae to nymphs. The Standard Data as interpolated from Gater's figure were given by Womersley and Heaslip 1943. In 1947 on a visit to the British Museum I was able to examine the type and one paratype, and I am now indebted to Dr. Audy for another paratype from Gater's collection in the Instit. for Medical Research at Kuala Lumpur. The Standard Data for these three specimens are:

	AW	PW	SB	ASB	PSB	SD	A–P	AM	AL	PL	Sens.
Type	41·6	66·0	22·0	17·6	—	—	—	—	—	—	—
Paraty.	41·6	66·0	22·0	17·6	—	—	22·0	22·0	18·0	30·0	—
Paraty.	44·8	61·6	22·4	16·8	19·6	36·4	19·6	22·4	16·8	33·6	—

The scutum is rectangular, wider than long, with AL the shortest and PL distinctly off the scutum; SB rather wide apart and somewhat nearer to AL than to PL, not the reverse as indicated by Gater's figure. Sensillae lanceolate and finely ciliated to 34μ long (according to Gater). The palpal claw is bifurcate and the setae on the femur, genu and tibia all nude or with one or two short indistinct barbs. The chelicerae are furnished only with the apical tricuspid cap. Galeal setae nude. There is no long nude seta on tarsi of leg III.

This species was chosen by Ewing as the type of *Ascoschöngastia,* but it is unfortunately rather an aberrant species in having PL situated off the scutum.

b. *Sensillae with more or less a basal stem.*

SCHÖNGASTIA (ASCOSCHÖNGASTIA) LIPOXENA sp. n.

Plate 52, fig. F–H.

Description of Larvae. Shape broadly oval. Length (engorged) to 1,235μ, width to 975μ. Mouth parts largely hidden under the dorsum. Scutum small, as figured, with anterior margin sinuous, posterior margin shallow behind line of PL; sensillae broadly lanceolate, strongly setulose, without a distinct basal stem; AL setae the shortest, PL the longest. Eyes ? absent. Chelicerae short

and stout, as figured, with only the apical tricuspid cap. Galeal setae nude. Palpi stout, tibial claw bifurcate; setae on femur and genu branched; on tibia only the ventral nude. Dorsal setae needle-like, apparently nude or with only short indistinct barbs; to 44μ long, ca. 26 in number, and arranged 2.6.6.6.4.2. Ventrally, with a pair of branched setae on maxillae, a ciliated seta on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 4.4.6.6.6.4.2, similar to but finer than dorsal. Legs: I 220μ long, II 195μ, III 220μ; tarsi I and II with dorsal sensory rod; III without any long nude seta.

The Standard Data for 31 specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	44·6±0·36	1·65±0·21	39·7–49·5	42·0–47·6	3·7
PW	60·3±0·44	2·43±0·31	53·0–67·6	56·0–64·4	4·0
SB	20·5±0·25	1·40±0·18	16·3–24·7	16·8–22·4	7·0
ASB	20·9±0·25	1·39±0·18	16·7–25·1	19·6–22·4	6·7
PSB	14·0	No variation recorded			
SD	34·9±0·25	1·39±0·18	30·7–39·1	33·6–36·4	4·0
A–P	27·2±0·29	1·61±0·20	22·4–32·0	25·2–30·8	5·9
AM	35·6±0·43	2·26±0·31	28·8–42·4	30·8–39·2	6·4
AL	31·9±0·37	1·91±0·26	26·2–37·6	28·0–33·6	6·0
PL	46·6±0·33	1·82±0·23	41·2–52·0	42·0–50·4	3·9
Sens.	61·6 with head 8·4 wide. No variation recorded.				

Loc. and Host. From bats No. 13944 and R.10566, 71 from Bukit Lagong Forest Reserve, Kepong, Kuala Lumpur, Malaya, March, 1950 J. R. Audy).

Remarks. In the form of the sensillae this species will come close to *lacunosa* Gater and *malayensis* Gater, differing from the first in the shape and size of the scutum, and from the second, in having PL on the scutum and the setae of the palpal femur and genu nude.

As all the specimens were very fully engorged and did not make very satisfactory mounts it has not been possible to figure the entire dorsal and ventral sides.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) NADCHATRAMI sp. n.

Plate 111, fig. H–J.

Description of Larvae. Shape (engorged) ovoid with rather parallel sides, slightly constricted medially. Length to 938μ, width to 670μ. Scutum as figured, only slightly wider posteriorly than long; PW greater than AW; anterior and posterior margins sinuous; posterior margin very shallow behind PL; sensillae missing, bases about in mid-line of scutum; PL very short, AL long and much longer than AM. Eyes 2 + 2, posterior the smaller. Chelicerae with only the apical tricuspid cap. Galeal setae nude. Palpi outwardly angu-

late, tibial claw bifurcate; setae on femur, genu and dorsally and laterally on tibia apparently nude, ventral on tibia with short ciliations. Dorsal setae ca. 42 in number, to 57μ long, and arranged 2.6.6.6.6.6.4.4.2. only very shortly ciliated or barbed, or perhaps quite nude. Ventrally with paired ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 46 setae, lengthening from 33μ to 59μ posteriorly, and more obviously ciliated. Legs: I 402μ long, II 348μ, III 469μ; tarsi I and II with dorsal sensory rods, III without any long nude seta.

The Standard Data for the type and 5 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	54·15±0·56	1·37±0·39	50·05–58·25	53·6–56·95	2·5
PW	70·9±1·03	2·52±0·73	63·35–78·45	67·0–73·7	3·5
SB	32·4±0·71	1·73±0·50	27·2–37·6	30·15–33·5	5·3
ASB	35·4±0·43	1·06±0·31	32·0–38·35	33·5–36·85	3·0
PSB	26·25±0·56	1·37±0·39	22·15–30·35	23·45–26·8	5·2
SD	61·4±1·13	2·77±0·80	53·1–69·7	56·95–63·65	4·5
A–P	53·05±0·56	1·37±0·39	48·95–57·15	50·25–53·6	2·6
AM	55·25±1·14	2·80±0·81	46·85–63·65	50·25–56·95	5·1
AL	73·1±2·91	7·14±2·06	51·7–94·5	67·0–83·75	9·8
PL	13·4		No variation recorded.		
Sens.	Missing in all specimens.				

Loc. and Host. Six specimens, 3 from *Rattus sabanus,* Bukit Lanjar Forest Reserve, Selangor, F.M.S., 4 Nov., 1950, 1 from same host, Kepong F.R. Selangor, 23 June, 1950, and 2 from *Rattus rajah,* from Ulu Langat F.R. Selangor, 21 July, 1950.

Remarks. This species in the shape of the scutum is close to *S.* (*A.*) *lacunosa* Gater, *S.* (*S.*) *lewthwaitei* sp. n. and *S.* (*A.*) *sarawakensis* sp. n. It differs from *lewthwaitei* in the quite non-serrate chelicerae; from *lacunosa* in the very short PL setae, and from *sarawakensis* in the Standard Data, especially the very long AL scutal setae.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) SARAWAKENSIS *sp.* n.

Plate 111, fig. D–G.

Description of Larvae. Shape (engorged) broadly oval with slight medial constriction. Length (engorged) to 730μ, width to 600μ. Scutum small as figured, almost quadrate, with AL longer than AM, and PL very short; sensillae rather short, clavate and setulose, with short but distinct basal stem, head as wide as long in ratio of 10:18; bases distinctly nearer to PL than to AL; contours as in typical *lacunosa.* Eyes 2 + 2, posterior the smaller. Chelicerae simple with only the apical tricuspid cap. Galeal setae nude. Palpi

rather angular on femur; seta on femur nude or with indistinct barbs; on genu nude and long; on tibia ventral with short branches, dorsal and lateral apparently nude; palpal claw bifurcate. Dorsal setae short and curved, to 57μ long, with short sparse barbs; ca. 42 in number and arranged ca. 2.6.6.6.6.-6.4.4.2. Ventrally with a pair of shortly ciliated or barbed setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 46–48 setae. Legs: I 321μ long, II 281μ, III 375μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for the type and 8 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	50·6±0·67	2·01±0·47	44·6–56·6	46·9–53·6	4·0
PW	65·1±0·81	2·43±0·57	57·8–72·4	60·3–67·0	3·7
SB	30·9±0·49	1·47±0·35	26·5–35·3	30·15–33·5	4·8
ASB	30·9±0·49	1·47±0·35	26·5–35·3	30·15–33·5	4·8
PSB	23·45		No variation recorded.		
SD	54·35±0·49	1·47±0·35	49·95–58·75	53·6–56·95	2·7
A–P	46·9		No variation recorded.		
AM	50·25		No variation recorded.		
AL	56·95		No variation recorded.		
PL	13·4		No variation recorded		
Sens.	23·45 with head 10·05/18·75. One determination only.				

Loc. and Hosts. The type and 8 paratypes from moon rat *Echinosorex gymnurus* from Tinjar, Sarawak, 15th June, 1950.

Remarks. This species is so close to typical *lacunosa* Gater, that one might be disposed to regard it only as a variety. It differs from the typical form in having a significantly smaller scutum, although of the same contours, and in having the sensillae much shorter and more clavate with a short but distinct basal stem. The AL scutal setae are distinctly longer than the AM seta, while the dorsal setae are shorter than (compare Standard Data) in typical *lacunosa* from Malaya.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) NAUSHERAENSIS sp. n.

Plate 52, fig. A–E.

Description of Larvae. Length (engorged) 390μ, unengorged 320μ, width 227μ and 214μ respectively. Shape broadly oval. Scutum as figured, roughly rectangular with posterior margin either almost rectilinear or shallow between PL (this is difficult to ascertain as some of the dorsal striations overlap the margin and obscure it); sensillae clavate, strongly setulose with the bases wide apart and only slightly nearer to PL than to AL; surface finely punctate. AM and AL subequal, PL longer. Eyes not discernible. Chelicerae non-serrate,

with only the apical cap. Galeal setae nude. Palpi stout, tibial claw bifurcate; setae on femur and genu strongly branched; on tibia ventral only branched. Dorsal setae to 30μ long, ca. 40 in number and arranged 2.10.8.8.2 lateral, 6.4.2. Ventrally a pair of ciliated setae on maxillae, one each on coxae I and II and three on coxae III, a pair between coxae I and between III, and thereafter ca. 26–28. Legs: I 195μ long, II 169μ, III 208μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for the type and eleven paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	50·5±0·44	1·52±0·31	46·0–55·0	47·6–53·2	3·0
PW	67·8±0·58	2·01±0·41	61·8–73·6	64·4–70·0	3·0
SB	37·3±0·53	1·82±0·37	31·8–42·8	33·6–39·2	5·0
ASB	22·3±0·12	0·40±0·08	21·1–23·5	21·0–22·4	1·8
PSB	22·3±0·12	0·40±0·08	21·1–23·5	21·0–22·4	1·8
SD	44·7±0·24	0·82±0·17	42·2–47·2	42·0–44·8	1·8
A–P	34·4±0·36	1·26±0·26	30·6–38·2	33·6–36·4	3·7
AM	20·0	No variation recorded			
AL	20·0	No variation recorded			
PL	30·25±0·18	0·62±0·13	28·4–32·1	30·0–32·0	2·1
Sens.	36·4 with head 13/22. No variation recorded.				

Loc. and Host. The type and eleven paratypes from ears of a mouse, Naushera, India, 14 May, 1949 (S.L.K.).

Remarks. This species is closely related to *lacunosa* Gater and *malayensis* Gater, but differs in the dorsal setae, setation of palpi, Standard Data, and especially the trisetose coxae III.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) DEBILIS (Gater 1932).

Neoschöngastia debilis Gater 1932. Parasitology, 24; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 118.

Plate 53, fig. A.

This species is still only known from the original specimen from the ear of *Rattus cremoriventer cremoriventer* (Muller) from Sungei Buloh, Selangor, F.M.S.

Gater's description is somewhat brief and he only figures the dorsal scutum, from which the sensillae were missing.

The scutum is almost rectangular with the posterior margin rectilinear between PL. The AL setae are the shortest and all are distinctly ciliated. The sensillae bases are about in the mid-line of the scutum or slightly in front of it. The chelicerae are non-serrate, apparently with only the apical tricuspid cap. The palpal claws are stated by Gater to be trifurcate, the setae on the

palpal femur and genu nude, and on the tibia the dorsal and lateral slightly pectinate, the ventral plain. Eyes apparently absent.

The dorsal setae number 54, and are arranged 2.12.4.8.7.10.2.5.4. The Standard Data from Gater's figure and data as computed by Womersley and Heaslip (1943) are: AW 40·0, PW 48·0, SB 17·0, ASB 13·0, PSB 11·0, SD 24·0, A–P 21·0, AM 30·0, AL 20·0, PL 36·0, Sens. —.

With its characteristic scutum this species should be readily recognized when again met with.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) MANIPURENSIS (Radford 1946).

Neoschöngastia manipurensis Radford 1946. Proc. Zool. Soc., London, 116, (2).

Plate 53, fig. B–D.

Described by Radford from *Rattus rattus rufescens* (Gray) from Imphal, Manipur, 13 June 1945, this species will fall into the *indica* group on the size of the dorsal scutum, AL scutal setae being the shortest, and the short rather stumpy front tarsi. It is strikingly different from all other members of the group in that PW is almost 3 times as long as AW, and in having both coxae II and III multisetose, II with 3 setae, III with 6 setae. The scutal setae are said to be nude. The dorsal setae are 30 in number, arranged 4.8.6.6.4.2, i.e. there are 2 scapular setae on each side. Ventrally behind coxae III the setae number ca. 36. No details or figures of the palpi are given by Radford, and I have not seen any material.

The Standard Data as given by Radford are: AW 25·0, PW 74·0, SB 21·0, ASB 23·0, PSB 20·0, SD 43·0, A–P 32·0, AM 20·0, AL 17·0, PL 27·0, Sens. 38·0. The value of 32·0 for A–P, however, is not in accordance with his figure of the scutum and is more probably an error for 42·0.

In the multisetose coxae II and III and the shape of the scutum this species might be placed in *Doloisia* Ouds. 1910 as suggested by Fuller 1948, if that genus can be validly separated from *Schöngastia* when the adults become known. It differs from the genotype of *Doloisia*, (*synote* Ouds. from Germany) in that coxae I is only unisetose.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) LABUANENSIS sp. n.

Plates 53, fig. E–J; 57, fig. B.

Description of Larvae. Shape oval. Length (partially engorged) 390μ, width 300μ. Dorsal scutum as figured, small, with the anterior margin lightly sinuous, posterior margin concave, the posterior angles produced; AL setae the

shortest but all shorter than usual; sensillae bases in the mid-line of scutum, sensillae missing, but possibly clavate. Eyes not observed, possibly absent. Chelicerae simple, broad and stout, with only the apical tricuspid cap. Galeal setae apparently nude. Palpi small, tibial claw short, bifurcate with subequal prongs; setae on palpal femur and genu with short setules, on tibia, dorsal and lateral ciliated, ventral apparently nude; tarsi with 4 or 5 ciliated setae, as well as subapical and sub-basal sensory rods. Dorsal setae short and setulose, to 22μ long, ca. 62 in number, arranged 2.10.10.10.10.10.6.4. Ventrally with a pair of branched setae on maxillae, a single ciliated seta on each coxa, a pair between coxae I and between coxae III and thereafter ca. 40, similar to dorsal, and to 20μ long. Legs, relatively short, segments short and stout, all 7-segmented, I 180μ long, II 150μ, III 180μ; tarsi I and II with the usual dorsal sensory rod, III without any long nude seta, or nude setae of any kind.

The Standard Data for the type and 4 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	28·8	No variation recorded			
PW	41·3±0·32	0·71±0·23	39·1–43·4	40·0–41·6	1·7
SB	13·45±0·59	1·31±0·42	9·5–17·4	12·8–16·0	9·5
ASB	14·4	No variation recorded			
PSB	11·2	No variation recorded			
SD	25·6	No variation recorded			
A–P	22·4	No variation recorded			
AM	16·0	No variation recorded			
AL	10·0	No variation recorded			
PL	19·2	No variation recorded			
Sens.	Missing.				

Loc. and Host. Five specimens from a marsupial rat from Labuan, British North Borneo, 17th Sept., 1945 (R. N. McCulloch).

Remarks. If this species should be found to have clavate sensillae it will, on the structure of the scutum, tarsi and palpal claw fall into the *indica* group of species as in the key.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) AUDYI sp. n.

Plates 54, fig. A–E; 57, fig. D.

Description of Larvae. Shape oval. Length (partially engorged) to 300μ, width to 200μ. Scutum roughly rectangular, with the anterior margin sinuous, posterior margin, lightly curved behind line of PL: AL setae the shortest; sen-

sillae clavate and setulose, their bases about the mid-line of scutum. Eyes 2 + 2 on ocular shields, closely adjacent to postero-lateral corners of scutum, posterior eyes the smaller. Chelicerae simple, with only the usual apical tricuspid cap. Galeal setae nude. Palpi stout, claw bifurcate with the prongs unequal, to 14μ long; setae on palpal femur and genu indistinctly barbed, on tibia all three nude; tarsi with subapical and sub-basal sensory rod-like setae and 4 or 5 ciliated setae. Dorsal setae 30 in number, to 36μ long, with short setulations and arranged 2.6.6.6.6.4.2. Ventrally with a pair of ciliated setae on maxillae, a single seta on each coxa, a single pair between coxae I and two pairs between coxae III, thereafter ca. 36, to 22μ long. Legs I 208μ long, II 184μ, III 218μ; tarsi I and II with the usual dorsal sensory rod, III with a long nude seta.

The Standard Data for the type and 6 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	49·5±0·92	2·26±0·65	42·7–56·3	47·6–53·2	4·5
PW	67·2±1·41	3·54±1·02	56·6–77·8	61·6–72·8	1·4
SB	22·6±0·56	1·38±0·40	18·5–26·7	21·0–25·2	6·1
ASB	26·6±0·63	1·53±0·44	22·0–31·2	25·2–28·0	5·7
PSB	22·4	No variation recorded			
SD	49·0±0·63	1·53±0·44	44·4–53·6	47·6–50·4	3·1
A–P	28·9±0·59	1·44±0·42	24·6–33·2	28·0–30·8	5·0
AM	31·7±0·59	1·44±0·42	27·4–36·0	30·8–33·6	4·5
AL	25·2	No variation recorded			
PL	39·7±0·47	1·14±0·33	36·3–43·1	39·2–42·0	2·9
Sens.	39·2 with head 11/22. No variation recorded.				

Loc. and Host. Described from the type, from Prome, S. Burma, 1945 (no host and further date recorded) and from 6 paratypes from *Rattus rattus norvegicus* from R.G.N. Pagoda Rd., S. Burma 14–16 Sept., 1945, (coll. T. J. Lawrence, type P11, paratypes 702–1, 706–4, 708–1). Also 7 specimens from *R. r. norvegicus* from Toungoo, S.B., 23 Oct., 1945 (768).

Remarks. At first glance this species suggests *lorius* Gunther, but careful study shows that it is quite distinct, differing in the number of dorsal and ventral setae, the longer and less stumpy palpal claw, and the presence of two pairs of setae between coxae III. I am pleased to name it after Dr. J. R. Audy, leader of the British Medical Research Council Typhus Team in Burma, and to whom I am indebted for the opportunity of studying so much of their material.

Another lot of five slides from the collection of Gater's material left

in the I.M.R., and forwarded to me by Dr. J. R. Audy are of this species. These slides were labelled in grease pencil "*sciurii*" and one of them "not to be published." The locality is not known but was most probably Sungei Buloh."

SCHÖNGASTIA (ASCOSCHÖNGASTIA) RATTUS (Wom. and Heaslip, 1943).

Neoschöngastia rattus Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 118.

Plates 54, fig. F–I; 55, fig. A; 57, fig. C.

This species was described from specimens from *Rattus assimilis* from Imbil and Brisbane, Queensland.

It is a rather characteristic species amongst those of the *indica* group in that the scutum is as long as it is wide between PL. The setae on the femur, genu and tibia of the palpi are all nude, and the claws are long, to 16μ and bifurcate. The dorsal setae are 2.6.6.4.2, as in *lorius* Gunther, but the ventral setae are much more numerous, ca. 40–50 in number. Tarsi III with 1 long nude outstanding seta.

The Standard Data, as redetermined for the type and 3 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	35·9±0·80	1·60±0·57	31·1–40·7	35·2–38·4	4·5
PW	64·8±0·80	1·60±0·57	60·0–69·6	64·0–67·2	2·5
SB	22·0±0·20	0·80±0·28	19·6–24·4	20·8–22·4	3·6
ASB	22·4	No variation recorded			
PSB	35·2	No variation recorded			
SD	57·6	No variation recorded			
A–P	41·6	No variation recorded			
AM	25·6	No variation recorded			
AL	12·8	No variation recorded			
PL	38·4	No variation recorded			
Sens.	35·2	Only 1 determination.			

SCHÖNGASTIA (ASCOSCHÖNGASTIA) LORIUS (Gunther 1939).

Neoschöngastia lorius Gunther 1939, Proc. Linn. Soc. New South Wales, 64, (1–2), 86; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 118.

Plates 55, fig. B–E; 57, fig. E.

This species was described from a parrot (*Lorius roratus*) from Bulolo, N. Guinea. Womersley and Heaslip (1943), recorded the Standard Data from their re-examination of the type and two paratypes as follows: AW 40·0,

PW 55·0–58·0 (aver. 56·5), SB 20·0, ASB 16·0, PSB 21·5–23·0 (aver. 22·25), SD 37·5–39·0 (aver. 38·25), A–P 21·5, AM 30·0, AL 17·0, PL 31·5–33·0 (aver. 32·0), Sens. 35·0 with head 10·0 wide. Gunther gave: scutal length 47·0, width 62·5, SB 20·0, AM 36·0, AL 25·0, PL 37·5, Sens. 30·0.

The dorsal setae are: 2.6.6.4.2.2, as given by Gunther, and not as quoted in error by Womersley and Heaslip (1943).

In addition it should be noted that the palpal claws, which are bifurcate, are short and stumpy, measuring only 7μ long, as compared with those of *audyi* n. sp. and *rattus* Wom. and Heaslip. A long nude seta on tarsi III.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) INDICA (Hirst 1915).

Schöngastia indica Hirst 1915, Bull. Ent. Res., 6, 183; Walch 1927, Geneesk. Tijds. v. Ned. Indie, 67, (6), 924.

Trombicula muris Walch 1922, Kitasato Archiv. Exper. Med., 5, (3); 1928, Fletcher, Lesslar and Lewthwaite, Tr. Roy. Soc. Trop. Med. and Hyg., 22, 161.

Neoschöngastia indica Gater 1932, Parasitology, 24, 156; Womersley and Heaslip 1943, 67, (1), 118; Radford 1942, Parasitology, 34, (1), 76; *idem* 1948, Parasitology, 37, (1), 48; Wharton, 1946, Ecol. Monogr., 16, 151–184.

Neoschöngastia cockingsi Radford 1946 Proc. Zool. Soc. London, 110, (2), 262.

Plates 55, fig. F–I; 56, fig. A; 57, fig. G.

Graph 1 and 2.

Dorsal scutum of small size, as figured, with AL the shortest; sensillae clavate with distinct setules and their bases in the mid-line of scutum and slightly nearer to PL than to AL; posterior margin rather shallow behind PL, but evenly curved or lightly concave medially. Chelicerae simple, with only the apical tricuspid cap. Galeal setae nude. Eyes 2 + 2, on distinct ocular shield, posterior eyes the smaller. Palpal claw short and stumpy, bifurcate, the prongs equal; setae on femur with a few short branches, on genu the same but often appearing nude, on tibia only the ventral branched. Dorsal setae rather slender, with short setules, 34 in number, arranged 4(2), 6(8), 6.6.6.4.2, to 25μ long; in the second row the seta on each side of the median pair is situated in front of the others and in line with the scapular setae, thus the first two rows may be read as 4.6, instead of 2.8. Tarsi III with one long nude setae.

The Standard Data derived from 41 specimens from Burma (T. J. Lawrence coll.) are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	38·4±0·27	1·71±0·19	33·3–43·5	33·6–42·0	4·4
PW	54·9±0·30	1·91±0·21	49·2–60·6	50·4–58·8	3·5
SB	20·5±0·20	1·26±0·14	16·7–24·3	18·2–22·4	6·1
ASB	22·8±0·14	0·93±0·10	20·0–25·6	21·0–25·2	4·0
PSB	19·5±0·06	0·36±0·04	18·4–20·6	18·2–19·6	1·8
SD	42·3±0·15	0·99±0·11	39·3–45·3	40·6–44·8	2·3
A–P	26·7±0·28	1·76±0·19	21·5–32·0	22·4–29·4	6·6
AM	24·6±0·29	1·73±0·20	19·4–29·8	22·4–28·0	7·0
AL	18·8±0·19	1·22±0·14	15·1–22·5	16·8–19·6	6·5
PL	31·1±0·22	1·41±0·15	26·9–35·3	28·0–33·6	4·5
Sens.	31·1±0·29	1·61±0·21	26·3–35·9	28·0–36·4	5·1

Remarks. Hirst in his original figure shows quite clearly the anterior position of the second seta from the middle of the second dorsal row. He also states: "Some of the hairs on the third leg are plain". The chaetotaxy of leg III however, has not been mentioned in detail by other workers, until Wharton (1946) described and figured it in detail, showing on the metatarsi one simple striated seta, and on the tarsi two long nude whip-like setae. The more distal of the latter two setae shown in his figure 2, is actually indistinctly branched, frequently appearing to be nude. There is, therefore, only a single long nude seta on tarsi III sub-basal in position.

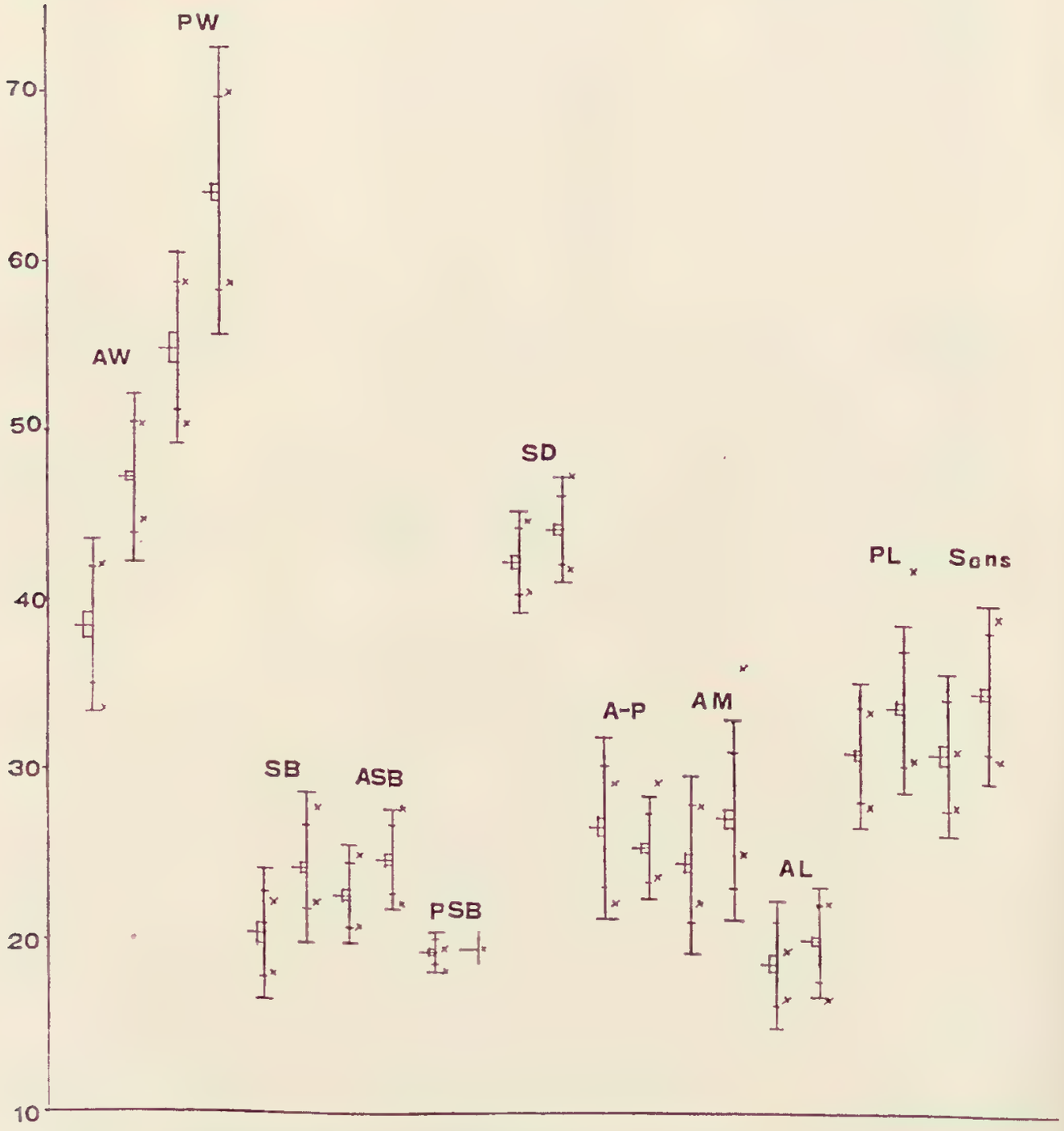
Schöngastia (*Ascoschöngastia*) *indica,* and *S.* (*A.*) *soekaboemiensis* Takekawa are two members of a small group of closely allied species, including *lorius* Gunther, *rattus* Womersley and Heaslip, and *audyi* sp. n. in which the dorsal scutum is of very similar shape, but differing in overall size, and in which the dorsal setae also vary in number.

Of these, *indica* and *soekaboemiensis*, while the scuta are different in Standard Data, at first sight appear to be only variants of one another in that the extreme lower number of DS in the first few dorsal rows of *soekaboemiensis* approaches that found in *indica.*

As pointed out in the key and the descriptions, the DS in *soekaboemiensis* number 40 to 42, and are arranged 2.10(8 or 9).8.6.6.6.4, with considerable variation, whereas in *indica* they number 34, arranged 4(2).6(8).6.6.6.4.2, with little variation, but the second row always has the seta on each side of the median pair inserted well in front of the others so that the first row may be read as 4, i.e. two scapular setae and two submedian.

The differences of these two species which in the field have been provisionally identified as *indica* are clearly shown in the accompanying graphs.

In Graph 1 the whole of the Standard Data are shown as follows: Mean, Range of Means expressed by Mean $\pm 3\sigma$, Theoretical Ranges expressed by Mean $\pm$ 3σ and by Mean $\pm$ 2σ, and the Observed Ranges. In all the larger and more important characters, AW, PW, etc., it is clear that the two species are very significantly distinct.

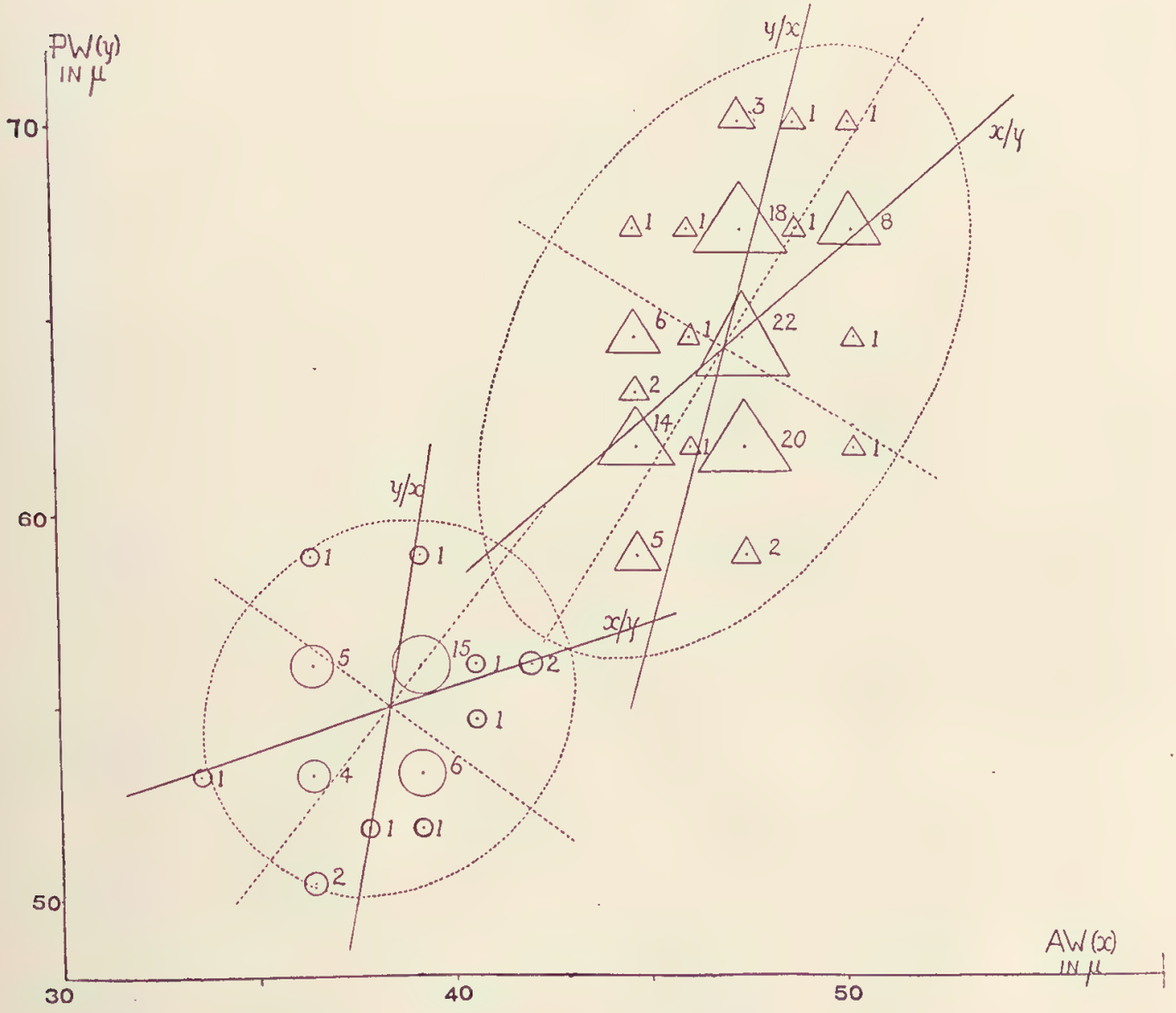


Graph I. Showing differences of Standard Data of population of (left) *Schöngastia* (*Ascoschöngastia*) *indica* (Hirst) and (right) *S.* (*A.*) *sockaboemiensis* Takekawa.

(Measurements in microns. Horizontal lines indicate Mean, Mean $\pm$ $3\sigma_M$, Range at M $\pm$ 3 times, and $\pm$ twice, Standard Deviation. Crosses indicate observed range.)

In Graph 2, the distribution of variations in the two species is shown by the regression lines for AW/PW and PW/AW. The distribution is seen to be elliptical, the theoretical ranges being indicated by the ellipses drawn using the value for Range/n. as given in Tippet's table (Biometrika 1925).

The circles and triangles indicate the number of specimens with value of AW. PW at the centre dots.



Graph II. Showing Regression Lines of AW.PW for populations of (left) *Schöngastia* (*Ascoschöngastia*) *indica* (Hirst) and (right) *S.* (*A.*) *sockaboemiensis* Takekawa.

The circles and triangles show the frequency of specimens with AW.PW at the centre points. The ellipses are drawn at the range/σ using Tippet's Table (Biometrika, 17, 386, 1925.).

SCHÖNGASTIA (ASCOSCHÖNGASTIA) SOEKABOEMIENSIS (Takekawa 1945).

Trombicula soekaboemiensis Takekawa S. 1945, Bull. from the Nampogun Bookikyusi Bu. No. 126; in Report of Kiyosi Hayakawa, 1946, Singapore.

Neoschöngastia soekaboemiensis, Hayakawa 1946 in Report "A Comparative Study of Japanese and Tropical (Scrub Typhus) Tsutsugamushi Disease" (figures only, Chart 13).

Plates 56, fig. B–F; 57, fig. F.

Graph 1 and 2.

Re-description of Larvae. Shape oval. Length (engorged) to 350μ, width to 260μ. Scutum trapezoidal, small, anterior and posterior margins sinuous, AL setae the smallest and placed distinctly back from anterior angles of scutum; sensillae clavate, their bases about in mid-line of scutum. Eyes 2 + 2, on ocular shields, posterior the smaller. Chelicerae simple, with only the apical tricuspid cap and a subapical rounded shoulder on dorsal (inner) margin. Galeal setae nude. Palpi stout; tibial claw short, bifurcate, prongs subequal, to 9μ long; seta on palpal femur, genu and tibia with short indistinct branches. Dorsal setae with distinct setules, fairly stout, to 32μ long, variable in number, 40 to 42, and arranged 2.10(8 or 9).8.6.6.6.4. Ventrally, a pair of ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 8.6.10.6.2.2, the anterior setae shorter and finer than the dorsal, the posterior setae much like the dorsal setae. Legs: I 185μ long, II 160μ, III 176μ, tarsi I and II with the usual dorsal sensory rod; III with one long nude outstanding seta.

The Standard Data derived from 109 specimens are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	47·15±0·16	1·64±0·11	42·25–52·05	44·8–50·4	3·5
PW	64·1±0·27	2·84±0·19	55·6–72·6	58·8–70·0	4·4
SB	24·4±0·14	1·49±0·10	20·0–28·8	22·4–28·0	6·1
ASB	24·9±0·09	0·97±0·07	22·0–27·8	22·4–28·0	3·9
PSB	19·6	No variation recorded			
SD	44·1±0·10	1·01±0·07	41·1–47·4	42·0–47·6	2·3
A–P	25·5±0·10	1·02±0·07	22·5–28·5	23·8–29·4	4·0
AM	27·2±0·20	1·92±0·14	21·4–33·0	25·2–36·4	7·1
AL	20·1±0·11	1·09±0·07	16·9–23·3	16·8–22·4	5·4
PL	33·8±0·16	1·64±0·11	28·9–38·7	30·8–42·0	4·9
Sens.	34·7±0·22	1·75±0·15	29·5–39·9	30·8–39·2	5·0

Loc. and Hosts. This species is very common in Southern Burma, occurring on *Nesokia bengalensis* and *Rattus rattus norvegicus.* Some hundreds of

specimens were collected by T. J. Lawrence of the British Medical Research Council Typhus Team in 1945.

Remarks. The species is closely related to *indica* in the general shape of the dorsal scutum and has been confused in the field with that species, under the name of *cockingsi* Radford (= *indica* Hirst). From this species, however, it differs in the lengths of AW and PW (see Standard Data) and in the number of dorsal seta. Normally the first three rows of dorsal setae are 2.10.8, as compared with 2.8.6 in *indica;* the second row however, varies somewhat, frequently having 9 setae and occasionally only 8, but these are always in more or less of a straight line. In *indica,* however, the dorsal setae are more delicate and the second seta on each side of the median pair in the second row is so far in front of the others as to be in line with the scapular setae.

A single specimen from *Bandicota bengalensis,* Paungde, S. Burma, Sept. 23rd, 1945 (T. J. Lawrence) had 2 AM setae very close together, and had in the field erroneously been thought to be a species of *Hannemania.*

The Bulletin in which this species was described was from the Japanese Army Institute of Preventive Medicine, Singapore during the Japanese occupation of Malaya. It was published in Japanese, but with well recognizable figures, the name in Latin and certain measurements in arabic figures. I am indebted to Lt. Col. J. R. Audy for a copy of the Bulletin and a tentative translation of certain details.

The specimens described were collected, mainly from the ears of *Rattus r. diardi* (Jentinck) and *R. r. roquei* Sodi (*R. r. jalorensis* (Bonhote)) in a bathing area of a camp at Soekaboemi, Java.

At least 200 specimens are referred to, but the location of the type and paratypes is unknown. In the Summary it is suggested that this species may be a vector of "tropical" tsutsugamushi disease.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) PERAMELES (Wom. 1939).

Neoschöngastia perameles Womersley 1939, Tr. Roy. Soc. S. Aust., 63, (2), 160; Womersley and Heaslip 1943, *ibid.,* 67, (1), 122.

Plates 56, fig. G–I; 57, fig. A.

This species was described from co-type material from bandicoots, *Isoodon torosus,* from Kiamba, Queensland, in June, 1938 (coll. D. J. W. Smith) together with specimens from the same host from Nambour, Q., May and Sept. 1938, by the same collector. Of this material in the S.A. Museum, that from Kiamba has now been divided into a type and 10 paratypes. Additional specimens from the same species of bandicoot were recorded in 1943, from Cairns,

while in the S.A. Mus. collection, not previously recorded are specimens from Yandina, Q. from the same hosts (coll. D.J.W.S., 5 May, 1938). No more recently collected material has been seen. The dorsal scutum is rather characteristic with PL nearer to AL than to the posterior margin, and not at the postero-lateral corners which are well rounded; the scutum is widest posterior of PL; AL the shortest, PL the longest. The chelicerae are simple with only the apical tricuspid cap. The galeal setae are nude. The palpal claw is trifurcate and all setae on femur, genu and tibia are branched; on femur with 5–6 branches; on genu 2–3; on tibia, ventral with 3 or 4, lateral 2–3 and dorsal 1 or 2 barbs. The dorsal setae number ca. 76, to 32μ long and arranged 2.12.12.12 (14),10.10.8.6.2. Ventrally the setae are to 26μ long, with 10–12 lying between coxae III.

The Standard Data derived from 45 specimens, including the type and 10 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	63·5±0·46	3·12±0·33	54·1–72·9	58·8–70·0	4·9
PW	78·7±0·44	2·96±0·31	69·8–87·6	72·6–84·0	3·7
SB	25·1±0·23	1·58±0·17	20·4–29·8	22·4–28·0	6·3
ASB	28·9±0·20	1·32±0·14	24·9–32·9	28·0–30·8	4·5
PSB	25·8±0·16	1·05±0·11	22·7–28·9	25·2–28·0	4·0
SD	54·7±0·25	1·68±0·18	49·7–59·7	53·2–58·8	3·0
A–P	21·9±0·23	1·56±0·16	17·2–26·6	19·6–25·2	7·0
AM	48·2±0·24	1·32±0·17	44·2–52·1	44·8–50·4	2·7
AL	38·6±0·43	2·83±0·30	30·1–47·1	33·6–42·0	7·3
PL	74·3±0·48	3·05±0·34	65·1–83·5	70·0–81·2	4·1
Sens.	42·0 with head 14/28. No variation recorded.				

Remarks. The figure of the dorsal scutum given in the original publication is not quite correct in the shape posterior of PL. The scutum is as figured in 1943 (*loc. cit.*) and herewith.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) SIMILIS (Wom. and Heasp. 1943).

Neoschöngastia similis Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 124.

Plate 58, fig. A–E.

This species was originally described from specimens taken from rats at Cairns, Queensland in 1939 (W. G. Heaslip). In the shape of the scutum with A–P very short and SB well behind line of PL it is closely related to *S.* (*A.*) *derricki* Wom. and Heasp. 1943 and *S.* (*A.*) *dasycerci* (Hirst 1929), but agreeing with the first only in having crenulate dorsal striations. From *der-*

ricki, it can be distinguished by the fewer dorsal setae which in the second row are ca. 98μ long, in the third row 70μ, and in the posterior rows as low as 50μ. The palpal claw is trifurcate, not bifurcate, and the setae on the palpal femur and genu have much fewer but longer branches than in *derricki*. In *dasycerci* the dorsal setae are more numerous and shorter than in either *derricki* or *similis*.

The Standard Data as redetermined for the type and 6 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	65·5±0·83	2·20±0·59	58·9–72·2	64·4–70·0	3·3
PW	87·2±0·73	1·93±0·52	81·4–93·0	84·0–89·6	2·2
SB	34·4±0·52	1·37±0·36	30·3–38·5	33·6–36·4	4·0
ASB	22·4	No variation recorded			
PSB	28·4±0·40	1·06±0·28	25·2–31·6	28·0–30·8	3·7
SD	50·8±0·40	1·06±0·28	47·6–54·0	50·4–53·2	2·1
A–P	16·8	No variation recorded			
AM	53·0	Only 1 determination			
AL	19·6	No variation recorded			
PL	99·2±1·48	3·91±1·04	87·5–110·0	92·4–103·6	3·9
Sens.	50·0 with head 11·0 wide. Original determination.				

SCHÖNGASTIA (ASCOSCHÖNGASTIA) DERRICKI (Wom. 1939).

Neoschöngastia derricki Womersley 1939, Tr. Roy. Soc. S. Aust., 63, (2), 162; Womersley and Heaslip 1943, *ibid*, 67, (1), 124.

Plates 58, fig. F–I; 59, fig. A.

This species was described from specimens from *Rattus lutreolus* and *R. assimilis*, from Imbil, Queensland in August, 1938 (D. J. W. Smith). In the shape and dimensions of the scutum with sensillae bases posterior of line of PL and the posterior scutal margin an even curve, it is closely related to *S.* (*A.*) *dasycerci* (Hirst 1929) and *S.* (*A.*) *similis* (Wom. and Heasp. 1943). Together with *similis* it differs from *dasycerci* in that the dorsal cuticula striations are markedly crenulate. From *similis* it can be distinguished, as given in the key, in the greater number of dorsal setae, the posterior of which are not very much shorter than the anterior. The palpal claw is bifurcate; the seta on palpal femur thickly but shortly ciliated, on genu rather less so, and on tibia the dorsal and lateral are nude and the ventral branched. The dorsal setae are 2.6.6.6.4.2, to 100μ anteriorly and 70μ posteriorly. The ventral setae to 30μ long. There is no long nude seta on tarsi III. The sensillae are wider than in *similis*.

The Standard Data as redetermined for the type and 9 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	68·0±0·43	1·35±0·30	64·0–72·0	67·2–70·0	2·0
PW	88·75±0·70	2·23±0·50	82·05–95·45	84·0–92·4	2·5
SB	34·7±0·46	1·45±0·32	30·4–39·0	33·6–36·4	4·2
ASB	25·2	No variation recorded			
PSB	25·2	No variation recorded			
SD	50·4	No variation recorded			
A–P	14·0	No variation recorded			
AM	52·85±0·70	4·35±1·09	39·8–65·9	44·8–56·0	8·2
AL	25·75±0·70	2·21±0·49	19·15–32·35	22·4–28·0	8·5
PL	86·25±1·00	3·18±0·71	76·7–95·8	84·0–92·4	3·7
Sens.	42·0 with head 16·8/30·8. No variation recorded.				

SCHÖNGASTIA (ASCOSCHÖNGASTIA) DASYCERCI (Hirst 1929).

Schöngastia dasycerci Hirst 1929, Proc. Zool. Soc., London, (2).

Neoschöngastia dasycerci, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 122.

Plate 59, fig. B–E.

This species was described from the ears of *Dasycercus cristicauda,* from Ooldea, South Australia.

The dorsal scutum is as figured with A–P short, and SB behind line of PL. The sensillae are clavate with prominent setules especially at the base of the head. AL slightly the shortest, being a little less than AM. The chelicerae is non-serrate with only the usual apical cap. The palpal claw is trifurcate; the setae on the palpal femur, genu and tibia are all branched or ciliated. The dorsal setae number 34, to 50μ long and are arranged 2.8.6.6.6.4.2. There are no long nude setae on tarsi III.

The Standard Data as redetermined for 7 of Hirst's co-types in the South Australian Museum collection are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	55·6±1·13	2·99±0·80	46·6–64·6	50·4–58·8	5·4
PW	65·2±1·33	3·51±0·94	54·7–75·7	61·6–70·0	5·3
SB	23·8±0·52	1·40±0·37	19·6–28·0	22·4–25·2	6·0
ASB	22·4	No variation recorded			
PSB	20·4±0·52	1·37±0·36	16·3–24·5	19·6–22·4	6·7
SD	42·8±0·52	1·37±0·36	38·7–46·9	42·0–44·8	3·2
A–P	14·0	No variation recorded			
AM	35·6±0·80	2·12±0·56	29·3–41·9	33·6–39·2	5·9
AL	21·3±0·48	1·07±0·34	18·1–24·5	19·6–22·4	5·0
PL	48·0±0·40	1·06±0·28	44·8–51·2	47·6–50·4	2·2
Sens.	43·9±0·93	1·62±0·66	39·1–48·7	42·0–44·8	3·7

A single specimen was taken along with 2 specimens of *S.* (*A.*) *coorongense* (Hirst) from *Rattus murrayi* var. on Greenly Is., South Australia, Dec., 1947 (F. J. Mitchell).

SCHÖNGASTIA (ASCOSCHÖNGASTIA) TRICHOSURI (Wom. 1939).

Neoschöngastia westraliensis var. *trichosuri* Womersley 1939, Tr. Roy. Soc. S. Aust., 63, (2), 160.

Neoschöngastia shieldsi Gunther 1941, Proc. Linn. Soc. New South Wales, 56, (3–4), 157; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 123.

Neoschöngastia trichosuri, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 122.

Plate 59, fig. F–J.

This species was described from a single specimen, from Nambour, Queensland. In 1943, Womersley and Heaslip raised it to specific rank and gave a much better figure of the dorsal scutum, the figure published in 1939 being incorrect in the shape of the posterior scutal margin. The unique type has been remounted and the scutum is now seen to be much as figured in 1943 and to agree with that figured by Gunther 1941 for his species, *shieldsi*, described from *Melomys rubex* Thomas, from Bulolo, New Guinea.

The Standard Data for *trichosuri* as remeasured are now found to be: AW 66·0, PW 95·2, SB 28·0, ASB 30·8, PSB 19·6, SD 50·4, A–P 28·0, AM 43·0, AL 35·0, PL 56·0. Sens. 40·0 with head 13·0. Those for *shieldsi* as deduced afresh from Gunther's data and figures (the types, said to be in the Australian Museum, Sydney have not been seen) are: AW 62·0, PW 75·0, SB 24·0, ASB 23·5, PSB 15·5, SD 39·0, A–P 15·0, AM 37·5, AL 45·0, PL 56·0, Sens. —.

The dorsal setae in *trichosuri* number 34, and are arranged 2.8.6.6.6.4.2, and measured to 45μ long, as shown by Gunther for *shieldsi.*

In both *trichosuri* and *shieldsi* the palpal claw is bifurcate, the setae on the palpal femur and genu branched (in Gunther's figure of *shieldsi,* but in his text he states "on *iii.* (*genu*) two (*branched setae*) at the base and one towards the apex." This is evidently a mistake, for in all known Trombiculidae there is only a simple seta on this palpal segment. On the palpal tibia the dorsal ventral and lateral setae are nude (Gunther only saw the ventral) (? branched) and one nude seta). The chelicerae are simple with only the apical cap, and the galeal setae are branched.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) HIRSTI (Wom. and Heasp. 1943).

Neoschöngastia hirsti Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 123.

Plate 60, fig. A–E.

This species was described from the type and 3 paratypes from *Melomys cervenipes*, from Imbil, Queensland, (coll. D. J. W. Smith 1938), and two specimens from rats, from Cairns, Queensland, 1938 (W. G. Heaslip). In addition I now have another specimen from rat from Wandecla, Q., 24 Jan., 1945 (R. N. McCulloch).

This species, as given in the key, is closely related *S.* (*A.*) *trichosuri* Wom. and Heasp. (= *shieldsi* (Gunther)) in having A–P short, SB behind the line of PL, and the posterior scutal margin being roughly three-sided. From *trichosuri* it differs in the rather larger scutum and in having AL setae much the shortest. The dorsal setae are of the same number and arrangement but measure to 70μ long whereas in *trichosuri* and according to Gunther's figures of *shieldsi* they do not exceed approximately 45μ. The palpal claw is trifurcate, and all the setae on femur, genu and tibia strongly ciliated, that on the femur being also very long. The chelicerae have only the apical tricuspid cap and the galeal setae are strongly ciliated. The sensillae are missing from all specimens.

The Standard Data for the above 7 specimens as remeasured are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	68·4±1·03	2·73±0·73	60·2–76·6	64·4–72·8	4·0
PW	82·0±0·80	2·12±0·57	75·7–88·3	78·4–84·0	2·6
SB	31·6±0·80	2·12±0·57	25·3–37·9	28·0–33·6	6·7
ASB	24·8±0·40	1·06±0·28	21·6–28·0	22·4–25·2	4·3
PSB	22·4	No variation recorded			
SD	47·2±0·40	1·06±0·28	44·0–50·4	44·8–47·6	2·3
A–P	18·2±0·48	1·28±0·34	14·4–22·0	16·8–19·2	7·0
AM	45·2±0·73	1·93±0·52	39·4–51·0	42·0–47·6	4·3
AL	25·2±0·61	1·62±0·43	20·4–30·0	22·4–28·0	6·4
PL	70·4±0·40	1·06±0·28	67·2–73·6	70·0–72·8	1·5
Sens.	Missing.				

From the shape and dimensions of the scutum, with SB behind line of PL and PSB less than A–P, the dorsal setae and the palpal setation, there seems little doubt but that *shieldsi* and *trichosuri* are synonymous.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) PHASCOGALE (Wom. and Heasp. 1943).

Neoschöngastia phascogale Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 127.

Plate 60, fig. F–J.

This species was described from the type and 3 paratypes from a wallaby, *Phascogale* sp., from Brisbane, Queensland, Jan., 1938 (D. J. W. Smith), and fifteen other specimens from bandicoots, *Isoodon torosus*, from Cairns (W. G. Heaslip 1940), and *Perameles nasuta*, Palm Woods, Queensland, Dec., 1938 (D.J.W.S.).

As given in the key, this species is closely related to *westraliense* Wom., *trichosuri* Wom. and *peregrina* sp. n. in having the sensillae bases almost in line with PL. It agrees with the first in having the palpal claw trifurcate and the galeal setae branched but differs in A–P being much greater than PSB and in the arrangement of the dorsal setae.

The Standard Data for the nineteen specimens given by Womersley and Heaslip (1943) treated statistically are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	71·6±0·37	1·63±0·26	66·7–76·5	68·0–75·0	2·3
PW	83·4±0·42	1·81±0·29	78·0–88·4	79·0–86·0	2·2
SB	30·0±0·23	1·00±0·16	27·0–33·0	28·0–32·0	3·3
ASB	30·0±0·27	1·11±0·19	26·7–33·3	27·0–32·0	3·7
PSB	23·6±0·16	0·74±0·12	21·4–25·8	22·0–25·0	3·1
SD	53·3±0·40	1·65±0·28	48·6–58·4	49·0–56·0	3·1
A–P	30·7±0·39	1·69±0·27	25·7–35·7	27·0–35·0	5·5
AM	53·65±0·33	1·37±0·23	49·55–57·75	50·0–55·0	2·5
AL	38·4±0·28	1·14±0·19	35·0–41·8	36·0–49·0	3·0
PL	63·1±0·70	3·02±0·49	54·0–72·2	56·0–67·0	4·8
Sens.	42·6±0·68	2·73±0·48	34·4–50·8	36·0–48·0	6·4

with head 12·0 wide.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) WESTRALIENSIS (Wom. 1934).

Schöngastia westraliense Womersley 1934, Rec. S. Aust. Mus., 5, (2), 215.

Neoschöngastia westraliensis Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 122.

Plate 61, fig. A–E.

This species is still only known from the original material, one slide containing about 17 specimens taken from the ears of a cat at Greenbushes, Western Australia, 11 Aug., 1931 (coll. H.W.).

The dorsal scutum is as figured with PL the longest. The posterior margin of the scutum is roughly 3-sided with the median part lightly concave. The sensillae are clavate with distinct setules, and their bases practically in line with PL. The chelicerae are simple with only the apical tricuspid cap. The galeal setae are distinctly branched or ciliated. Eyes 2 + 2, posterior the smaller. The palpi are stout, with the tibial claw trifurcate. The setae on the palpal femur and genu are strongly branched; on the tibia the dorsal and lateral nude, ventral branched. The dorsal setae number 34, and are arranged 2.8.6.6.6(4).4(6).2, to 56μ long.

The Standard Data for 15 of the specimens as remeasured are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	82·9±0·63	2·46±0·45	75·5–90·3	75·6–84·0	3·0
PW	99·9±0·63	2·43±0·44	92·6–107·2	95·2–103·6	2·4
SB	36·1±0·43	1·68±0·31	31·1–41·1	33·6–39·2	4·6
ASB	30·4±0·25	0·95±0·17	27·6–33·2	28·0–30·8	3·1
PSB	24·8±0·25	0·95±0·17	22·0–27·6	22·4–25·2	3·8
SD	55·2±0·40	1·54±0·28	50·6–59·8	50·4–56·0	2·8
A–P	26·5±0·45	1·73±0·32	21·3–31·7	25·2–30·8	6·5
AM	53·4±0·84	2·90±0·59	44·7–62·1	47·6–56·0	5·4
AL	48·1±0·54	2·09±0·38	41·8–54·4	44·8–50·4	4·3
PL	79·5±0·70	2·68±0·49	71·5–87·5	75·6–84·0	3·3
Sens.	42·0 with head 14·0 wide. No variation recorded.				

SCHÖNGASTIA (ASCOSCHÖNGASTIA) PEREGRINA sp. n.

Plate 61, fig. F–J.

Description of Larvae. Shape oval. Length (unengorged) to 450μ, width to 375μ. Scutum large and roughly trapezoidal, with the posterior margin fairly deep behind line of PL and slightly sinuous or concave medially; sensillae bases only slightly behind PL and A–P longer than PSB; AL the shortest, PL the longest; sensillae clavate with strong setules. Chelicerae simple with only the usual apical tricuspid cap. Galeal setae nude. Eyes 2+ 2, the posterior the smaller. Palpi stout, tibial claw bifurcate; seta on both femur and genu strongly branched; on tibia dorsal and lateral nude, ventral strongly branched. Dorsal setae 34, arranged 2.8.6.6.6.4.2 to 60μ long. Ventrally with a pair of ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, and behind coxae III with ca. 6.4.6.4.8.6.4.4 setae to 40μ long. Legs: I 310μ long, II 270μ, III 330μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for the type and 5 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	79·3±0·59	1·45±0·42	75·0–83·6	78·4–81·2	1·8
PW	99·2±0·56	1·38±0·40	95·1–103·3	98·0–100·8	1·4
SB	35·9±0·47	1·14±0·33	32·5–39·3	33·6–36·0	3·2
ASB	30·3±0·47	1·14±0·33	26·9–33·7	28·0–30·8	3·8
PSB	20·1±0·47	1·14±0·33	16·7–23·5	19·6–22·4	5·7
SD	50·4	No variation recorded			
A–P	25·2	No variation recorded			
AM	47·6	No variation recorded			
AL	40·6±0·95	2·34±0·67	33·6–47·6	36·4–42·0	5·8
PL	70·1±0·67	1·65±0·47	65·2–75·0	67·6–72·8	2·3
Sens.	44·8 with head 11·2. No variation recorded.				

Loc. The type and five paratypes from boots, Johnston's Pass, Wongabel, Queensland, Feb., 1945 (R. N. McCulloch).

Remarks. In the shape and dimensions of the scutum and the dorsal setae this species is near to *S.* (*A.*) *westraliensis* (Wom.) but differs in the bifurcate palpal claw, and the nude galeal setae.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) HEASLIPI (Wom. and Heasp. 1943).

Neoschöngastia heaslipi Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 120.

Plate 62, fig. A–E.

This species which was described from the type and two paratypes from rats from Intake, Cairns, Queensland (coll. 1940, W.G.H.), is distinguished from all others in the genus *Schöngastia,* except *traubi* sp. n. in that the dorsal setae arise from the centre of small platelets, the diameters of which are approximately half the length of the setae.

The dorsal scutum is as figured with the posterior margin only moderately deeper behind PL and only lightly concave medially; sensillae clavate, setulose and their bases in front of line of PL. The PL setae are the longest and AL the shortest but all scutal setae are subequal. The palpal claw is trifurcate; the seta on femur with 4 or 5 branches, on genu with apparently only 2 branches, and all 3 setae on tibia nude; on the palpal tarsus the sub-basal sensory rod is exceptionally long. The dorsal setae number 54, each one on a separate small plate, arranged 2.6.8.8.8.4.6.6.4.2, and from 27 to 52μ long. Leg 1 7-segmented, II and III 6-segmented, as in *oudemansi* Walch.

The Standard Data for the type and 2 paratypes as given by Womersley and Heaslip 1943 and treated statistically are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	62·0±1·73	3·00±1·22	53·0–71·0	59·0–65·0	4·8
PW	78·0±1·53	2·64±1·08	70·1–85·9	75·0–80·0	3·4
SB	29·0	No variation recorded			
ASB	26·7±1·33	2·31±0·94	19·8–33·6	24·0–28·0	8·6
PSB	23·7±0·33	0·58±0·23	22·0–25·4	23·0–24·0	2·4
SD	50·3±1·20	2·08±0·85	44·1–56·5	48·0–52·0	4·0
A–P	36·0±0·82	1·41±0·58	31·8–40·2	34·0–38·0	3·9
AM	46·0	No variation recorded			
AL	33·0±0·58	1·00±0·41	30·0–36·0	32·0–34·0	3·0
PL	49·0	No variation recorded			
Sens.	39·3±0·33 with head 13·0 wide.	0·58±0·23	37·6–41·0	39·0–40·0	1·5

SCHÖNGASTIA (ASCOSCHÖNGASTIA) TRAUBI sp. n.

Plate 62, fig. F–I.

Description of Larvae. Shape almost round. Length (unengorged) 195μ, width 162μ. Scutum as figured, almost rectangular; PL setae the shortest, AM the longest. SB rather wide apart and about the midline of the scutum; sensillae rather narrowly clavate and ciliated. Eyes 2 + 2. Chelicerae non-serrate, with only the apical tricuspid cap. Galeal setae nude. Palpi with bifurcate tibial claw; all setae of femur, genu and tibia apparently nude. Dorsal setae on distinct platelets, ca. 38 in number, to 30μ long, shortly ciliated and arranged 2.6.2.6.8.8.4.2. Ventrally with a pair of branched maxillary setae, a ciliated seta on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 40 setae in rows of 12 to 6, followed by 8 to 10 setae on platelets as on the dorsum. Legs: fairly stout, I 7-segmented and 220μ long, II and III 6-segmented and 195μ and 245μ respectively; no long nude seta on tarsi III.

The Standard Data derived from the type and 3 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	63·0±0·81	1·62±0·57	58·2–67·8	61·6–64·4	2·5
PW	75·95±0·35	0·70±0·25	73·85–78·05	75·6–77·0	0·9
SB	37·8±0·81	1·62±0·57	33·0–42·6	36·4–39·2	4·3
ASB	28·0	No variation recorded			
PSB	25·2	No variation recorded			
SD	53·2	No variation recorded			
A–P	37·8±0·81	1·62±0·57	33·0–42·6	36·4–39·2	4·3
AM	42·0	No variation recorded			
AL	34·8±0·76	1·51±0·53	30·3–39·3	33·6–36·4	4·3
PL	22·4	No variation recorded			
Sens.	47·6 by 6·0 wide. One determination only.				

Loc. and Host. The type and 3 paratypes (No. 3,969, ex *Suncus* sp.) from Shingbwiyang, Burma, 23 Oct., 1945 (coll. R. Traub and D. D. Millspaugh for

U.S.A. Typhus Commission). Also 2 specimens from *Rattus sabanus*, from Ulu Langat, Kuala Lumpur, Malaya, 5 Dec., 1949 (J. R. Audy).

Remarks. This species is very closely related to *S.* (*A.*) *heaslipi* Wom. and Heasp. 1943 in having the dorsal setae arising from distinct platelets. It differs however, in having only a bifurcate palpal claw, nude setae on palpal femur and genu, and in having some of the posterior ventral setae also on platelets. Together with *heaslipi* it agrees with *S.* (*A.*) *oudemansi* in having the femora of legs II and III undivided and it also resembles *oudemansi* in the shape of the scutum and the short PL setae, but differs in the non-serrate chelicerae and the dorsal platelets.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) LAWRENCEI nom. nov.

Neoschöngastia guntheri Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 126, (preoc. Radford 1942).

Plate 63, fig. A–E.

As the specific name *guntheri* was used by Radford 1942 (Parasitology) for a species of *Neoschöngastia* (*Ascoschöngastia*) from Colorado, the name of the Australian species is now changed to *lawrencei* in honour of Dr. F. R. Lawrence, Director of the Natal Museum.

The dorsal scutum is as figured, with posterior margin fairly deep behind line of PL and slightly concave medially; the sensillae are clavate with prominent setules, and their bases in front of line of PL; AL is slightly the shortest and PL the longest. The chelicerae are simple with only the apical tricuspid cap. Galeal setae long, slender and nude. Palpi stout, with trifurcate tibial claw; setae on femur and genu branched, on tibia all 3 setae nude. Dorsal setae numerous, ca. 80 in number, arranged 2.12.12.12.12.10.8.6.4.2, to 75μ long. Tarsi III without any long nude seta.

The Standard Data for the 17 specimens as given by Womersley and Heaslip 1943 treated statistically are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	77·6±0·50	2·06±0·35	71·4–83·8	75·0–81·0	2·7
PW	97·2±0·59	2·44±0·42	89·9–104·5	94·0–103·0	2·5
SB	31·4±0·23	0·93±0·16	28·6–34·2	30·0–32·0	3·0
ASB	30·1±0·54	2·23±0·38	23·4–36·8	27·0–35·0	7·4
PSB	27·1±0·47	1·93±0·33	21·3–32·9	24·0–32·0	7·1
SD	57·2±0·78	3·23±0·55	48·3–66·9	54·0–64·0	5·6
A–P	32·2±0·48	1·98±0·34	26·3–38·1	27·0–36·0	6·0
AM	57·0±0·82	3·16±0·58	47·5–66·5	49·0–60·0	5·5
AL	39·7±0·32	1·32±0·23	35·7–43·7	37·0–41·0	3·3
PL	67·2±0·40	1·67±0·29	62·2–72·2	65·0–70·0	2·5
Sens.	51·8±0·29	1·17±0·21	48·3–55·3	49·0–54·0	2·2

with head 12·0 wide.

This species was described from the type and 18 paratypes from a rat from Cairns, Queensland (1939–40, W.G.H.) and in the South Australian Museum collection is another slide of 6 specimens from a rat from Wongabel, Q., Feb., 1945 (R.N.McC.).

Its relationship to other species is best seen from the key. It is close to *wongabelensis* sp. n., *smithi*, and *cairnsensis* in having SB in front of PL, but differs in the more numerous dorsal setae and other details.

It is renamed in honour of Dr. R. F. Lawrence, Director of Natal Museum.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) WONGABELENSIS sp. n.

Plate 63, fig. F–J.

Description of Larvae. Shape oval. Length (engorged) 450μ, width 230μ. Scutum large as figured, finely and indistinctly punctate, anterior margin lightly sinuous; posterior margin rounded laterally and flattened medially and fairly deep behind line of PL; AL very short, PL the longest; sensillae fairly widely clavate with prominent setules, and the sensillae bases well in front of PL. Eyes 2 + 2, on distinct ocular shields, posterior the smaller. Chelicerae simple, with only the apical tricuspid cap. Galeal setae nude. Palpi stout, with trifurcate tibial claw; setae on palpal femur with many long branches; seta on genu with 1 long branch; on tibia all three setae nude; tarsi with 4 or 5 ciliated setae and the usual basal and subapical sensory rods. Dorsal setae tapering and ciliated to 45μ long, 20–22 in number and arranged 2.6.6(4).4(6). 2.2(0). Ventrally with the usual pair of branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 40, arranged 8.6.8.8.6.2.2.2, to 20μ long. Legs: I 210μ long, II 200μ, III 250μ; tarsi I and II with the usual dorsal sensory rod; III without any long nude seta.

The Standard Data for the type and four paratypes and six other specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	74·6±0·57	1·89±0·40	68·9–80·3	72·8–78·4	2·5
PW	102·3±0·44	1·46±0·31	97·9–106·7	100·8–103·6	1·4
SB	45·6±0·55	1·81±0·39	40·2–50·8	42·0–47·6	4·0
ASB	31·3±0·34	1·13±0·24	28·9–34·7	30·8–33·6	3·6
PSB	41·0±0·43	1·41±0·30	36·8–45·2	39·2–42·0	3·4
SD	72·3±0·66	2·10±0·45	66·0–78·6	70·0–75·6	2·9
A–P	45·3±0·74	2·45±0·52	38·0–52·6	47·0–47·6	5·4
AM	43·2±0·57	1·50±0·40	38·7–47·7	42·0–44·8	3·5
AL	24·1±0·46	1·45±0·32	19·8–28·4	22·4–25·2	6·0
PL	51·2±0·55	1·81±0·39	45·8–56·6	47·6–53·2	3·5
Sens.	44·8 with head 16·8 wide. No variation recorded.				

Loc. and Host. The type and 5 paratypes from a water rat from Wongabel, Q., Feb., 1945 (R. N. McCulloch), and 5 other specimens from the same locality, host?, Feb., 1945 (R.N.Mc.).

Remarks. A characteristic species separated as in the key.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) SMITHI (Wom. 1939).

Neoschöngastia smithi Womersley 1939, Tr. Roy. Soc. S. Aust., 63, (2), 164; Womersley and Heaslip 1943, *ibid.*, 67, (1), 127.

Plate 65, fig. A–E.

No further specimens of this species, described from *Rattus assimilis*, from Imbil, Queensland, have been seen.

In the key it is closely related *S.* (*A.*) *cairnsensis* from which it differs in the number of dorsal setae and the branched galeal setae.

The dorsal setae number 46, and are arranged 2.8.8.8.8.6.4.2. The dorsal scutum is deep behind PL with A–P approximately equal to PSB.

Originally known from the type and 2 paratypes, only the type now exists, but the Standard Data as given by Womersley and Heaslip in 1943 for the three specimens and treated statistically are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	70·0	No variation recorded			
PW	81·0	No variation recorded			
SB	27·0	No variation recorded			
ASB	30·0	No variation recorded			
PSB	24·0	No variation recorded			
SD	54·0	No variation recorded			
A–P	29·7±1·45	2·51±1·03	22·1–37·3	27·0–32·0	8·5
AM	53·0±1·15	2·00±0·81	47·0–59·0	51·0–55·0	3·8
AL	34·7±1·76	3·05±1·25	25·6–43·8	32·0–38·0	8·9
PL	63·0±1·58	1·00±0·41	60·0–66·0	62·0–64·0	1·6
Sens.	43·0	Only one determination.			

SCHÖNGASTIA (ASCOSCHÖNGASTIA) RAUI sp. n.

Plate 64, fig. A–D.

Description of Larvae. Shape an elongate oval with slight tendency when unfed to a constriction posterior of coxae III. Colour reddish. Length (only lightly fed) 195μ, width 162μ. Scutum as figured with anterior margin sinuate, posterior margin shallowly rounded. Sensillae clavate on the distal half, with apex of club somewhat flattened, bases wide apart and in front of line of PL; sensillary club either nude or only indistinctly setulose; ordinary scutal setae shortly and indistinctly ciliated. Eyes 2 + 2, close to postero-lateral

corners of scutum. Chelicerae simple with only the apical tricuspid cap. Galeal setae nude. Palpi stout with bifurcate tibial claw; setae on palpal femur, genu and tibia apparently nude. Dorsal setae tapering shortly ciliated, 28 in number, to 36μ long, and arranged 2.8.6.6.4.2. Ventrally with a pair of ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 30 setae only slightly shorter than dorsal. Legs all 7-segmented, I 227μ long, II 195μ, III 227μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for the type and 3 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	62·3±0·70	1·40±0·49	58·1–66·5	61·6–64·4	2·2
PW	86·1±0·70	1·40±0·49	81·9–90·3	84·0–86·8	1·6
SB	30·8	No variation recorded			
ASB	25·2	No variation recorded			
PSB	25·2	No variation recorded			
SD	50·4	No variation recorded			
A–P	23·8±0·81	1·61±0·57	19·0–28·6	22·4–25·2	6·5
AM	39·2±1·14	2·28±0·81	32·4–46·0	36·4–42·0	5·8
AL	27·1±0·93	1·62±0·66	22·3–31·9	25·2–28·0	5·9
PL	41·3±1·34	2·68±0·95	33·2–49·4	39·2–44·8	6·5
Sens.	47·6 with head 8·4/19·6. No variation recorded.				

Loc. and Host. The type and three paratypes from beneath the belly scales of a skink *Leiolopisma guichenoti* Dumeril and Bibron from Middle River, Kangaroo Is., South Australia (coll. A. Rau, March, 1950).

Remarks. The relationship of this species is best seen from the key. The form of the sensillae is somewhat unusual. It is named after the finder of the host.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) CAIRNSENSIS (Wom. and Heasp. 1943).

Neoschöngastia cairnsensis Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 128.

Plate 65, fig. F–J.

This species is very common and widely distributed in Queensland and was recorded by Womersley and Heaslip 1943, from bandicoots, *Isoodon torosus* Cairns, 1939 (W.G.H.) and Brisbane, 1938 (W.G.H.) and from Cowan Cowan 1939 (D. J. W. Smith); also from rats from Cairns 1939 (W.G.H.), from *Rattus assimilis,* and *R. lutreolus;* and from *R. youngi* from Cowan Cowan 1938 (D.J.W.S.).

Of this original material, that from bandicoots from Brisbane, 1938 (W.G.H.) comprising 8 specimens is regarded as the type series, consisting of the type and 7 paratypes.

The palpal claw is trifurcate, and the seta on palpal femur 4–5 branched, on genu 1–2 short branches, on tibia all 3 setae nude. The chelicerae are simple with only the apical tricuspid cap, and the galeal setae are nude. The dorsal scutum is as figured, with the posterior margin rather shallow behind PL and lightly concave medially; the lateral margins are lightly concave; the sensillae are somewhat broadly clavate, with pronounced setules, and their bases in front of line of PL. The dorsal setae number 32, to 70μ long, and arranged 2.6.6.6.6.4.2.

The Standard Data shows rather a large variation and for 62 specimens of the original material are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	56·2±0·31	2·46±0·22	48·8–63·6	50·4–61·6	4·4
PW	82·8±0·62	4·91±0·44	68·1–97·5	72·8–98·0	5·9
SB	29·5±0·27	2·10±0·19	23·4–35·8	25·2–36·4	7·1
ASB	29·5±0·19	1·48±0·13	25·1–33·9	25·2–30·8	5·0
PSB	20·2±0·16	1·27±0·11	16·4–24·0	19·6–25·2	6·3
SD	49·7±0·26	2·05±0·18	43·5–55·9	44·8–56·0	4·2
A–P	33·7±0·29	2·27±0·20	26·9–40·5	28·0–39·2	6·7
AM	40·9±0·24	1·75±0·17	35·6–46·2	36·4–44·8	4·3
AL	31·2±0·29	2·22±0·21	24·5–37·9	28·0–36·4	7·1
PL	51·25±0·37	2·76±0·26	42·95–59·55	44·8–56·0	5·4
Sens.	37·5±0·91	3·17±0·65	28·0–47·0	33·6–42·0	8·4

with head 14·0 wide.

var. GATERI (Wom. and Heasp. 1943).

Neoschöngastia cairnsensis v. *gateri* Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 129.

Plate 65, fig. K.

This was recorded as a variety of *cairnsensis* only differing in the larger dorsal scutum.

The Standard Data of the type and 4 of the five paratypes from rats at Cairns, 1939 (W.G.H.) are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	69·4±1·05	2·34±0·74	62·4–76·4	67·2–72·8	3·4
PW	99·7±4·21	9·41±2·98	71·5–127·9	89·6–112·0	9·4
SB	35·8±0·56	1·25±0·39	32·0–39·6	33·6–36·4	3·5
ASB	31·9±0·69	1·53±0·48	27·3–36·5	30·8–33·6	4·8
PSB	25·2	No variation recorded			
SD	57·1±0·69	1·53±0·48	52·5–61·7	56·0–58·8	2·7
A–P	39·2±1·53	3·42±1·08	29·0–49·4	33·6–42·0	8·7
AM	42·7±1·34	2·68±0·95	34·7–50·7	39·2–44·8	6·3
AL	31·2±0·56	1·26±0·40	27·4–35·0	30·8–33·6	4·0
PL	55·3±2·65	5·30±1·87	39·4–71·2	47·6–58·8	9·6
Sens.	39·2 with head 14·0 wide. Only one determination.				

Key to the Larval Species of SCHONGASTIA Ouds. 1910.

1. Chelicerae serrate on dorsal (inner) margin 2
   Subgen. *Schöngastia* s. str. Ewing 1946.

   Chelicerae non-serrate on dorsal margin 14
   Subgen. *Ascoschöngastia* Ewing 1946.

2. All legs 7-segmented, i.e. femora secondarily subdivided. Tarsi III with a long outstanding nude seta, except in *oculicola* sp. n. 3

   Legs II and III 6-segmented, femur not subdivided. Tarsi III without any long nude seta. Scutum trapezoidal with posterior margin shallow behind line of PL. 2a

2a. Scutum smaller. Sensillae clavate. DS 30 in number, arranged 2.6.6.6.6.4.

   AW 51·4±9·8, PW 66·1±7·0, SB 30·65±5·55, ASB 25·6, PSB 19·45±2·2, SD 45·2±2·8, A–P 34·0±2·2, AM 34·7±3·6, AL 22·65±3·75, PL 13·55±3·35, Sens. 38·0 with head 9·6 wide.
   Schön. (*Schön.*) *oudemansi* (Walch 1923).
   = *impar* Gunther 1939.
   = *bodensis* Gunther 1940.

   Scutum larger. Sensillae ? DS 42 in number, arranged 2.6.6.6.6.-6.4.4.2 to 45μ long.

   AW 68·0±4·8, PW 86·0±18·5, SB 38·4, ASB 35·2±7·8, PSB 22·4, SD 57·6±7·8, A–P 44·8±7·8, AM 34·4±4·8, AL 35·2, PL 36·0±4·8, Sens. ?
   Schön. (*Schön.*) *lewthwaitei* sp. n.

3. Palpal claw trifurcate 7

   Palpal claw bifurcate 4

4. Sensillae bases in line with or slightly in advance of PL. Scutum hexagonal. Sensillae globose 5

   Sensillae bases placed well behind line of PL 6

5. Sensillae nude or only indistinctly villous under oil immersion. Scutum larger. DS ca. 2.10.8(10).2.10.6.6.4.2(4) = 50–54.

   AW 66·9±9·9, PW 88·65±13·65, SB 25·8±2·5, ASB 35·5 ±2·9, PSB 28·7±2·2, SD 64·1±3·5, A–P 31·7±3·4, AM 37·3 ±4·9, AL 77·8±9·8, PL 58·1±4·4, Sens. 32·1±1·6 with head 16/19.
   Schön. (*Schön.*) *vandersandei* Ouds. 1905.

   Sensillae distinctly setulose. Scutum smaller. DS ca. 2.8.10.10.6.2 = 38.

   AW 53·1±8·4, PW 70·0±6·1, SB 20·5±·0, ASB 27·0±4·2, PSB 22·55±1·85, SD 49·6±4·8, A–P 23·7±4·1, AM 27·8±6·1, AL 54·4±8·4, PL 43·1±9·9, Sens 32·0 with head 12·8/19·2.
   Schön. (*Schön.*) *schuffneri* (Walch 1923).

6. Scutum hexagonal, but A–P shorter than the postero-lateral sides. DS ca. 2.10.2.13.2.14.12.12.8.4 = ca. 80.

   AW 62·4±2·5, PW 79·0, SB 21·2±1·3, ASB 35·0, PSB 23·5, SD 58·5, A–P 23·5, AM 41·0±4·2, AL 77·6±10·2, PL 57·0±7·3, Sens. 35·0 with head 15/19.

   Schön. (*Schön.*) *taylori* Gunther 1940.

   Scutum not hexagonal, posterior margin deep behind line of PL and strongly evenly rounded. A–P approx. 1-3rd the scutal depth. DS 2.8.8.8.6.4 = 36.

   AW 50·4±4·8, PW 64·0, SB 18·0±4·6, ASB 25·6, PSB 22·4, SD 48·0, A–P 14·4±5·6, AM 34·4±9·2, AL 56·8±4·8, PL 49·6 ±5·6. Sens. 32·0 with head 16/22.

   Schön. (*Schön.*) *whartoni* sp. n.

7. Scutum pentagonal 8

   Scutum not pentagonal 9

8. Sensillae clavate. Scutal and dorsal setae relatively short, rod-like, with short ciliations. Chelicerae with only two strong teeth on dorsal margin. All palpal setae on femur, genu and tibia nude. DS ca. 2.10(8).6.6.4 = 30–32.

   AW 53·55±5·25, PW 69·7±3·9, SB 22·0±3·5, ASB 22·8±3·4, PSB 22·4, SD 45·2=3·4, A–P 26·8±5·0, AM 16·0, AL 28·8, PL 32·0, Sens. 32·8±4·8 with head 6·0 wide.

   Schön. (*Schön.*) *bidentata* sp. n.

   Sensillae globose. Scutal and dorsal setae normal with long ciliations. Chelicerae with more than two teeth. Seta on palpal femur branched, on genu nude. DS 2.8.6.6.4.4.2 = 32.

   AW 53·8±6·4, PW 73·0±6·9, SB 19·7±1·2, ASB 26·2±1·1, PSB 26·9±3·2, SD 53·1±2·1, A–P 30·8±1·7, AM 28·2±5·6, AL 60·3±13·8, PL 59·7±6·6, Sens. 39·3±3·0 with head 15/19.

   Schön. (*Schön.*) *vieta* Gater 1932.

9. Scutum hexagonal with the antero- and postero-lateral sides about equal, posterior side lightly concave 10

   Scutum not hexagonal 12

10. Seta on palpal genu nude. Chelicerae rather short and curved. DS ca. 2.8.6.6.4(4).2 = 28–32.

    AW 48·6±7·5, PW 69·6±2·7, SB 18·4±2·7, ASB 24·0, PSB 21·0, SD 45·0, A–P 23·6±2·7, AM 22·2±4·9, AL 59·2±3·3, PL 42·6±7·5, Sens. 30·0 with head 15/18.

    Schön. (*Schön.*) *philipi* Wom. and Kohls, 1947

    Seta on palpal genu branched. Chelicerae longer and straighter. DS 50 to 64 in number 11

11. Scutal and setae on palpal femur and genu only short branched. No crescent in front of each sensilla base. Sensillae bases nearer to one another than they are distant from each PL. DS ca. 2.12.8.8.10.8.4.2 = 54. (Gunther gives 64.)

AW 65·7±7·7, PW 86·0±10·0, SB 25·9±2·8, ASB 32·8±5·0, PSB 27·0±5·2, SD 59·8±5·6, A–P 30·4±4·8, AM 34·9±5·9, AL 67·1±9·0, PL 51·35±7·2, Sens. 33·5±4·6, with head 19/19.

Schön. (*Schön.*) *blestowei* Gunther 1939.

Scutal and setae on palpal femur and genu long branched. A distinct crescent in front of each sensilla base. Sensillae bases as far apart, or slightly more, than they are distant from each PL. DS ca. 2.12(14).12(10).12.10.6.2 = 56.

AW 57·7±5·8, PW 80·3±5·2, SB 32·2±2·4, ASB 30·2±6·2, PSB 23·0±3·3, SD 53·2±4·4, A–P 24·4±7·1,AM 38·55±3·15, AL 67·65±9·35, PL 57·2±6·0, Sens. 33·15±8·3 with head 19/20.

Schön. (*Schön.*) *blestowei* var. *megapodius* Wom. and Heasp. 1943.

12. Lateral parts of posterior scutal margin almost in line with PL and lightly concave, middle part strongly convex and deeper behind line of PL. Sensillae globose, ciliated, apparently with only short peduncles, and their bases placed well in advance of PL. Seta on palpal femur with only a few indistinct branches, on genu nude. Chelicerae short and stumpy. DS fine, tapering, with indistinct short ciliations, ca. 2.4.4.8.8.6.4.2 =38.

AW 44·8, PW 70·4, SB 16·0, ASB 22·4, PSB 19·2, SD 41·6, A–P 28·8, AM 16·0, AL 36·0, PL 48·0, Sens. 22·0 with head 16/16.

Schön. (*Schön.*) *oculicola* sp. n.

All the posterior scutal margin deep behind line of PL, laterally rounded and medially straight 13

13. Scutum much wider than long. Setae on femur and genu of palpi with only a few short indistinct branches. DS 2.8.6.6.6.4.2 =34.

AW 57·0±14·2, PW 78·1±10·9, SB 22·4, ASB 25·6, PSB 23·05±2·65, SD 48·65±2·65, A–P 28·8, AM 26·2±4·3, AL 66·1±8·9, PL 53·9±3·2, Sens. 35·2 with head 13/19.

Schön. (*Schön.*) *pseudoschuffneri* (Walch 1927).

Scutum not much wider than long, almost quadrate, with strong punctations. Setae on palpal femur and genu more distinctly and longer branched. DS 2.8.6.6.6.4.2.2 = 36.

AW 51·2, PW 66·0, SB 16·0, ASB 25·6, PSB 25·6, SD 51·2, A–P 28·8, AM 28·8, AL 54·4, PL 48·0, Sens. 32·0 with head 15/20.

Schön. (*Schön.*) *maldiviensis* (Radford 1946).

14. Some or all dorsal setae as well as PL and sometimes AL or AM foliate. *foliata* group 15

All scutal and dorsal setae normal and non-foliate 18

15. Galeal setae ciliated or branched. Dorsal scutum with posterior corners well rounded. PL nearer to AL than to posterior margin. Sensillae bases behind line of PL. Only PL and all DS except posterior two rows long and foliate with small serrations or denticles. Palpal claw trifurcate, all setae on femur, genu and tibia strongly branched. DS 38, arranged 2.8.6.6.6.6.2.2 to 85μ long.

AW 70·4, PW 84·3±5·6, SB 32·0±9·6, ASB 28·8, PSB 24·5, ±2·8, SD 52·3±7·3, A–P 16·0, AM 54·4, AL 25·6, PL 81·1± 5·6, Sens. —. *Schön.* (*Ascoschön.*) *pseudomys* sp. n.

Galeal setae nude 16

16. Scutum relatively deep behind line of PL. Sens. bases slightly behind line of PL. All dorsal setae as well as AL and PL very broadly foliate with long and strong denticles or teeth. Palpal claw trifurcate; setae on palpal femur and genu branched; on tibia all 3 apparently nude. DS 26 in number, arranged 2.6.6.6.4.2, and to 48–60μ long. Sensillae capitate and apparently nude.

AW 60·0, PW 85·0, SB 24·0, ASB 30·0, PSB 21·0, SD 51·0, A–P 29·0, AM 21·0, AL 42·0, PL 56·0, Sens. 32·0. *Schön.* (*Ascoschön.*) *mccullochi* (Wom. 1944).

Scutum not so deep behind PL. Sens. bases well in front of line of PL. Foliate setae with smaller denticles 17

17. All DS foliate with the denticles longer. AL and PL foliate. Palpal claw bifurcate, all setae on palpal femur, genu and tibia apparently nude. DS 28, to 64μ long and arranged 2.6.6.6.6.2. Sens. 28μ with head 17/17 and apparently nude.

AW 50·6±14·8, PW 69·5±6·0, SB 19·0±4·2, ASB 21·0, PSB 18·0, SD 39·0, A–P 21·6±3·6, AM 16·5±4·9, AL 49·5±4·9, PL 60·0±4·8, Sens. 28·0 with head 17/17. (After Wom. and Kohls). *Schön.* (*Ascoschön.*) *uromys* (Wom. and Kohls 1947).

All DS foliate except outer members of posterior 3 rows, denticles shorter and more in the nature of ciliations. Only PL of scutum foliate. Palpal claw trifurcate; setae on femur and genu ciliated; on tibia dorsal and lateral nude, ventral branched. Sens. capitate, with fine short setules.

AW 53·0, PW 70·0, SB 17·5, ASB 19·5, PSB 17·5, SD 37·0, A–P 25·0, AL 57·0, PL 86·0, Sens. 28·0, (after Gunther). *Schön.* (*Ascoschön.*) *foliata* (Gunther 1940).

18. Sensillae globose 19

Sensillae clavate, sometimes broadly so, or lanceolate 41

19. Sensillae bases very close together, not more than 15μ or 16μ apart. *globulare* group 20

Sensillae bases widely separated 25

20. PL the longest 21

AL the longest 22

21. Sensillae bases in front of line of PL. Posterior scutal margin shallow behind PL. PL longer than PW. Coxae III 1-setose. Sens. nude. DS 2.10.8.6.6.4.2 = 38.

AW 41·9±2·7, PW 64·0, SB 12·5±1·8, ASB 22·4, PSB 11·6± 3·0, SD 34·0±3·0, A–P 31·5±2·4, AM 29·4±5·8, AL 63·4± 8·4, PL 70·9±8·3, Sens. 35·2 with head 19·6/22·4.

Schön. (*Ascoschön.*) *signata* sp. n.

Sensillae bases behind line of PL. Posterior scutal margin as even curve and deeper behind line of PL. PL about as long as PW. Coxae III 3(4)-setose.

AW 57·6, PW 73·6, SB 11·2, ASB 22·4, PSB 12·8, SD 35·2, A–P 22·4, AM ?, AL ?, PL ?, Sens. 25·0 with head 15/19 (after Walch). *Schön.* (*Ascoschön.*) *globulare* (Walch 1927).

22. Coxae III 1-setose. Sens. bases posterior of PL 23

Coxae III multisetose 24

23. Dorsal setae ca. 86, and to 40–50μ long. All setae on palpal tibia branched or ciliated.

AW 52·3±6·5, PW 63·6±5·7, SB 9·6±2·7, ASB 24·3±3·8, PSB 8·5±2·8, SD 32·8±3·8, A–P 19·7±3·3, AM 22·5±9·1, AL 45·5±4·6, PL 34·3±7·5, Sens. 24·6±11·1.

Schön. (*Ascoschön.*) *kohlsi* Philip and Woodward 1946.

Dorsal setae more than 110, and to 28μ long. All 3 setae on palpal tibia branched.

AW 59·0, PW 70·0, SB 10·0, ASB 28·0, PSB 14·0, SD 42·0, A–P 18·0, AM 24·0, AL 42·0, PL 31·0, Sens. 30·0 with head 18/18. *Schön.* (*Ascoschön.*) *comata* sp. n.

24. Coxae III 2-setose. Posterior scutal margin deep and 3-sided. Sens. bases behind line of PL. Palpal claw trifurcate, all setae ciliated. Galeal setae nude. DS 38 in number, to 38μ long and arranged 2.8.6.6.8.4.2.2.

AW 57·1±8·0, PW 70·9±8·0, SB 9·2±2·1, ASB 25·6, PSB 12·8, SD 38·4, A–P 17·8±4·3, AM 32·3±5·2, AL 56·1±6·6, PL 45·6±4·3, Sens. 28·8 with head 16/19.

Schön. (*Ascoschön.*) *lanius* (Radford 1946).

Coxae III 3–5-setose. Posterior scutal margin shallower and an even curve. Sens. bases slightly in front of PL. Galeal setae nude. Palpal claw trifurcate; setae on palpal femur and genu with a few short ciliations; on tibia dorsal and lateral nude or with a few indistinct ciliations, ventral branched. DS 40 in number, to 38μ long and arranged ca. 2.8.6.6.8.2.4.2.2.

AW 48·0, PW 62·0, SB 9·0, ASB 26·0, PSB 13·0, SD 39·0, A–P 26·0, AM 29·0, AL 53·0, PL 40·0, Sens. ?.

Schön. (*Ascoschön.*) *mutabilis* (Gater 1932).

25. Palpal claw bifurcate 26
Palpal claw trifurcate 28

26. A long nude seta on tarsi III. Scutum larger, more or less six-sided with posterior margin deep behind PL and only slightly concave medially. Galeal setae nude. Setae on palpal femur and genu branched; on tibia, dorsal and lateral nude, ventral branched. Sensillae capitate, with distinct setules and placed just behind line of PL. DS 62, to 50μ long and arranged 2.14.14.10.12.8.4.

AW 76·0, PW 96·0, SB 38·0, ASB 32·0, PSB 29·0, SD 61·0, A–P 29·0, AM 48·0, AL 80·0, PL 72·0, Sens. 28·0.

Schön. (*Ascoschön.*) *edwardsi* (Gunther 1939).

No long nude seta on tarsi III 27

27. Dorsal setae normal and ciliated. Scutum with posterior margin strongly sinuate and deeply concave medially. Galeal setae nude. Setae on palpal femur and genu branched; on tibia, dorsal and lateral nude, ventral branched. Sensillae capitate, with distinct setules, and in line with PL. DS 32–34, to 30μ long and arranged 2.6.6.6.6.4(2).2.

AW 54·6±5·5, PW 79·2±6·6, SB 23·0±5·4, ASB 21·0, PSB 12·3±3·6, SD 33·3±3·6, A–P 25·0, AM 24·5±3·6, AL 44·7 ±6·5, PL 53·1±6·6, Sens. 29·0.

Schön. (*Ascoschön.*) *philippensis* (Philip and Woodward 1946).

Dorsal setae strong, with 5–6 lateral long teeth. Galeal setae nude. Seta on palpal femur strongly ciliated, on genu much finer with few branches; on tibia, all 3 nude. Sensillae capitate, with distinct fine setules and well behind line of PL. DS approx. 100 to 70–56μ long and arranged ca. 8.16.18, plus.

AW 58·8, PW 75·6, SB 33·6, ASB 25·2, PSB 16·8, SD 42·0, A–P 14·0, AM 53·2, AL 30·8, PL 78·4, Sens. 36·4 with head 19·6/25·2. *Schön.* (*Ascoschön.*) *mackerrasae* sp. n.

28. PL setae situated off the scutum. Coxae III 2-setose. Palpal claw trifurcate; seta on femur branched, on genu long and nude, on tibia dorsal and ventral branched. DS 46 in number, arranged 2.10.8.10.-8.6.2 to 25μ.

AW 38–42(40), PW 66–74(70), SB 19–24(21), ASB 14–19(17), PSB 13–16(14), SD 27–35(31), A–P 32, AM 28, AL 14, PL 24, Sens. 30–32(31).

Schön. (*Ascoschön.*) *masta* Traub and Sundermeyer 1950.

PL setae on the scutum 29

29. Coxae III 2-setose. Scutum with posterior margin well rounded laterally, flat medially and deep behind line of PL. Setae on palpal femur and genu strongly branched; on tibia, dorsal and lateral nude, ventral branched. Galeal setae nude. Sensillae setulose. DS 2 plus ca. 10 rows of 10 each, to 45μ long with long outstanding ciliations.

AW 73·5±4·9, PW 98·8±9·0, SB 34·7±6·2, ASB 32·0, PSB 30·0, SD 62·0, A–P 36·0, AM 41·0±4·7, AL 49·7±7·7, PL 55·0±4·7, Sens. 32·0. *Schön.* (*Ascoschön.*) *petrogale* (Wom. 1934).

Coxae III 1-setose 30

30. PL setae placed much nearer to AL, and not at the postero-lateral angles of the scutum. Dorsal cuticular striations very finely crenulate 31

PL setae placed at the postero-lateral angles of scutum 32

31. DS 44 in number, to 55–65μ long, and arranged 2.10.10.10.6.4.2. PL relatively further from AL and scutum only slightly wider posterior of PL than distance between PL.

AW 74·2±8·8, PW 87·0±8·7, SB 28·3±3·6, ASB 29·2±4·0, PSB 30·0, SD 59·2±4·0, A–P 21·8±3·5, AM 56·4±2·7, AL 46·0±7·5, PL 78·0±6·3, Sens. 36·0.

Schön. (*Ascoschön.*) *mohri* sp. n.

DS more than 100 in number, to 60μ long, and arranged ca. 2.14.12. 16.12.12.12.10.8.6.4. PL relatively nearer to AL, and scutum posterior of PL much wider than between PL.

AW 83·7±10·5, PW 92·3±12·1, SB 30·7±3·45, ASB 33·3± 6·9, PSB 30·0, SD 63·3±6·9, A–P 17·0±5·2, AM 54·0, AL 45·7±6·9, PL 90·0, Sens. ? *Schön.* (*Ascoschön.*) *crinita* sp. n.

32. PW less than 15μ longer than AW 33

PW more than 15μ longer than AW 35

33. Sens. bases very wide apart and nearer to lateral scutal margins than to one another; and nearer to line of AL than to line of PL. Scutum posteriorly overlapped by dorsal cuticle. Only the setae on palpal femur and genu, and the ventral on tibia branched. A long nude seta on tarsi III. Dorsal setae 36–38, arranged 2.8.6.8.6 (4).4.2.2, to 60μ long.

AW 76·2±3·8, PW 81·8±7·0, SB 47·0±3·8, ASB 28·0, PSB 31·9±1·9, SD 59·9±1·9, A–P 30·8, AM 54·0±12·0, AL 82·9 ±9·5, PL 58·2±7·0, Sens. 39·2 with head 23/25.

Schön. (*Ascoschön.*) *rectangulare* sp.n.

Sens. bases as near, or nearer to one another than to lateral scutal margins and much nearer to line of PL than line of AL. Scutum not overlapped by dorsal cuticle 34

34. Scutum deep with A–P about 2/3 PW. Sensillae bases distinctly in front of line of PL. Dorsal setae to 52 in number, to 60μ long, and arranged 2.6.8.8.8.8.6.4.2. All setae on palpal femur, genu and tibia branched.

AW 60·8±2·4, PW 69·6±7·5, SB 25·2, ASB 28·8±4·1, PSB 19·6, SD 48·4±5·2, A–P 39·2±4·8, AM 38·2±4·0, AL 67·8 ±7·0, PL 59·9±9·6, Sens. 28·0 with head 22·4/22·4.

Schön. (*Ascoschön.*) *antipodianum* (Hirst 1929).

Scutum shallower, with A–P about 1/3 PW. Sensillae bases about in line with PL. Dorsal setae thicker and stronger, 32 in number to 56μ long, and arranged 2.6.6.6.6.4.2. Setae on palpal femur, and genu branched, on tibia all 3 nude.

AW 60·7±4·8, PW 72·8±8·4, SB 19·6, ASB 25·2 PSB 16·8, SD 42·0, A–P 23·3±4·8, AM 40·0, AL 71·9±14·0, PL 79·3± 24·2, Sens. 30·8 with head 19·6/19·6.

Schön. (*Ascoschön.*) *cassiope* sp. n.

35. Dorsal cuticular striations finely and closely crenulate. Scutum with anterior margin convex and posterior margin somewhat angular. Sens. bases anterior of line of PL. Scutal setae relatively short, PL the longest. Setae on palpal femur and genu branched; on tibia only ventral branched. DS 52, to 30μ long, arranged 2.10.10.10.8.6.4.2.

AW 58·8, PW 75·6, SB 22·4, ASB 22·4, PSB 22·4, SD 44·8, A–P 25·2, AM 45·0, AL 33·6, PL 56·0, Sens. 36·4 with head 19·6/ 19·6. *Schön.* (*Ascoschön.*) *dumosa* sp. n.

Dorsal cuticular striations not crenulate 36

36. First row of DS with 4 setae, 2 scapular and 2 submedial. Posterior scutal margin shallow and almost rectilinear between PL. Setae on palpal femur and genu, and ventrally on tibia branched. Dorsal setae 26, to 50μ long and arranged 4.6.6.6.2.2.

AW 57·9±7·0, PW 99·7±7·8, SB 29·8±5·1, ASB 31·6±2·5, PSB 18·8±3·1, SD 50·4±5·7, A–P 42·8±8·1, AM 39·4±4·1, AL 70·85±9·25, PL 67·1±5·6, Sens. 40·0.

Schön. (*Ascoschön.*) *queenslandica* (Womersley 1939).

First row of DS with only the two scapular setae 37

37. PL setae longer than PW 38

PL setae not longer than PW 39

38. PL not greatly longer than PW. Ventral seta of palpal tibia nude or with only one branch.

AW 54·0±6·0, PW 70·4±7·2, SB 19·6±3·8, ASB 25·2, PSB 19·6, SD 44·8, A–P 27·8±3·6, AM 31·6±9·2, AL 70·4±4·8, PL 80·9±10·9, Sens. 33·6 with head 16·8/19·6.

Schön. (*Ascoschön.*) *lappacea* n. comb.

PL twice as long as PW, and much longer than AL. Ventral seta of palpal tibia strongly branched. DS 28, to 75μ long, and arranged 2.6.6.6.2(4).4(2).2.

AW 47·95±5·4, PW 68·95±8·9, SB 19·25±3·0, ASB 28·0, PSB 18·9±3·9, SD 46·9±3·9, A–P 31·5±3·9, AM 39·2±4·9, AL 84·0, PL 134·6±14·2, Sens. 33·6 with head 16·8/19·6.

Schön. (*Ascoschön.*) *womersleyi* (Gunther 1939).

39. With AL setae the shortest. Sensillae further apart, with strong setules. All setae on palpal tibia nude. DS 32, to 45μ long, and arranged 2.6.6.6.6.4.2.

AW 70·9±10·8, PW 95·95±17·45, SB 32·8±4·3, ASB 30·8 ±4·3, PSB 22·4, SD 53·2±4·3, A–P 34·5±5·9, AM 49·1±5·2, AL 42·0±5·3, PL 64·4±11·0, Sens. 33·6 with head 19·6/19·6.

Schön. (*Ascoschön.*) *coorongense* (Hirst 1929)

With AM the shortest 40

40. Scutum posterior of PL very shallow, margin between PL almost rectilinear. DS 34–38, arranged 2.8.6.6.6.4.5(2).2(0). to 30μ long.

AW 45·3±3·5, PW 61·5±6·4, SB 20·4±3·5, ASB 21·0, PSB 15·0, SD 36·0, A–P 31·3±4·5, AM 26·6±4·5, AL 46·5±7·1, PL 42·6±4·5, Sens. 27·0 with head 17/17.

Schön. (*Ascoschön.*) *echymipera* (Wom. and Kohls 1947).

Scutum deeper behind line of PL. DS 32, arranged 2.6.6.6.6.4.2.

AW 47·8±9·1, PW 72·1±11·9, SB 21·5±4·5, ASB 28·0, PSB 19·6, SD 47·6, A–P 27·9±2·8, AM 28·55±3·55, AL 54·9±4·3, PL 47·6±5·0, Sens. 35·0.

Schön. (*Ascoschön.*) *innisfailensis* (Wom. and Heasp. 1943).

AW 51·7±5·9, PW 81·3±11·5, SB 21·4±5·5, ASB 25·0±4·3, PSB 21·9±4·4, SD 47·0±7·1, A–P 28·8±2·8, AM 30·4±6·9, AL 60·2±13·2, PL 56·3±7·2, Sens. 31·4±5·6.

Schön. (*Ascoschön.*) *innisfailensis f. bushlandi* (Philip 1947).

41. Sensillae long and narrow, almost lanceolate and without a true basal stem 42

Sensillae clavate, with more or less of a basal stem 43

42. Dorsal scutum larger, subquadrate, with PL the shortest and distinctly on scutum at postero-lateral corners. Seta on palpal genu very long. DS ca. 2.6.8.8.6.4.2. (but variable from 44–52 according to Gater).

AW 64·0±8·8, PW 75·2±5·9, SB 37·3±2·0, ASB 30·7±3·2, PSB 24·0±4·9, SD 54·45±7·2, A–P 44·0±3·5, AM 44·95±3·5, AL 35·5±2·8, PL 26·5±3·5, Sens. 54·0 with head 6·7 wide.

Schön. (*Ascoschön.*) *lacunosa* (Gater 1932).

Dorsal scutum small, with AW not greater than 50μ. PL placed distinctly off the scutum. DS 0.8.8.6.4 to 30μ. Posterior scutal margin shallow and almost rectilinear between posterior corners. Setae on palpal femur, genu and tibia nude or with only a few indistinct barbs.

AW 41·8, PW 66·0, SB 22·0, ASB 17·6, PSB 8·4, SD 26·0, A–P 22·0, AM 22·0, AL 18·0, PL 30·0, Sens. ca. 34·0.

Schön. (*Ascoschön.*) *malayensis* Gater 1932).

Dorsal scutum also small, AW not greater than 50μ, and with AL the shortest. PL on the scutum, DS 2.6.6.6.4.2. to 44μ. Posterior scutal margin shallow behind PL and concave medially. Setae on palpal femur and genu ciliated; on tibia only ventral branched.

AW 44·6±4·9, PW 60·3±7·3, SB 20·5±4·2, ASB 20·9±4·2, PSB 14·0, SD 34·9±4·2, A–P 27·2±4·8, AM 35·6±6·8, AL 31·9±5·7, PL 46·6±5·4, Sens. 61·6 with head 8·4 wide.

Schön. (*Ascoschön.*) *lipoxena* sp. n.

43. Scutum small, with AW ca. 50μ or less 44
Scutum much larger with AW much more than 55μ 52

44. Dorsal scutum with AW ca. 50–55μ, with PL very much shorter than AM or AL; and with AL at the antero-lateral angles 44a
Dorsal scutum with AW ca. 50μ or less. AL the longest 44b

44a. Scutum larger, with AL longest and longer than PW.

AW 54·15±4·1, PW 70·9±7·5, SB 32·4±5·2, ASB 35·4±3·2, PSB 26·25±4·1, SD 61·4±8·3, A–P 53·05, AM 55·25±8·4, AL 73·1±21·4, PL 13·4, Sens. ? *Schön.* (*Ascoschön.*) *nadchatrami* sp. n.

Scutum smaller, with AL the longest but not longer than PW.

AW 50·6±6·0, PW 65·1±7·3, SB 30·9±4·4, ASB 30·9±4·4, PSB 23·45, SD 54·35±4·4, A–P 46·9, AM 50·25, AL 56·95, PL 13·4, Sens. 23·45 with head 10·05/18·75.

Schön. (*Ascoschön.*) *sarawakensis* sp. n.

44b. Dorsal scutum small, AW ca. 50μ, with AL at the antero-lateral angles; posterior margin a shallow even curve; PL the longest. Sens. fairly broadly clavate, and setulose, bases wide apart. Palpal claw bifurcate; setae on femur and genu branched; on tibia only ventral branched. Coxae III 3-setose.

AW 50·5±4·5, PW 67·8±6·0, SB 37·3±5·5, ASB 22·3±1·2, PSB 22·3±1·2, SD 44·7±2·4, A–P 34·4±3·8, AM 20·0, AL 20·0, PL 30·25±1·85, Sens. 36·4 with head 13/22.

Schön. (*Ascoschön.*) *nausheraensis* sp. n.

Scutum geenrally with AW less than 50μ, and with AL well back from the rounded antero-lateral shoulders. *indica* group 45

45. Posterior scutal margin rectilinear between PL 46
Posterior scutal margin curved or sinuous between PL 47

46. Scutum rectangular, with AW not much shorter than PW. Scutal setae strongly ciliated.

AW 40·0, PW 48·0, SB 17·0, ASB 13·0, PSB 11·0, SD 24·0, A–P 21·0, AM 30·0, AL 20·0, PL 36·0, Sens. —. (After Gater 1932; Womersley and Heaslip 1943).

Schön. (*Ascoschön.*) *debilis* (Gater 1932).

Scutum not rectangular, with AW ca. 1/3 length of PW, lateral sides strongly converging forwardly. Scutal and dorsal setae shortly and indistinctly ciliated.

AW 25·0, PW 74·0, SB 21·0, ASB 23·0, PSB 20·0, SD 43·0, A–P 42·0, AM 20·0 AL 17·0, PL 27·0, Sens. 38·0, (after Radford 1946). *Schön.* (*Ascoschön.*) *manipurensis* (Radford 1946).

47. Posterior scutal margin concave. All palpal setae ciliated. DS ca. 62 in number, arranged 2.10.10.10.10.10.6.4, to 29μ long. No long nude seta on tarsi III.

AW 28·8 PW 41·3±2·1, SB 13·4±3·9, ASB 14·4, PSB 11·2, SD 25·6, A–P 22·4, AM 16·0, AL 10·0, PL 19·2, Sens. —.

Schön. (*Ascoschön.*) *labuanensis* sp. n.

Posterior scutal margin convex or convexly sinuous. A fairly long nude seta on tarsi III 48

48. Palpal claws short and stumpy 50

Palpal claws longer and more pointed 49

49. Scutum much wider between PL than long. Two pairs of setae between coxae III. DS 30 in number and arranged 2.6.6.6.6.4. to 36μ.

AW 49·5±6·8, PW 67·2±10·6, SB 22·6±4·1, ASB 26·6±4·6, PSB 22·4, SD 42·0±4·6, A–P 28·9±4·3, AM 31·7±4·3, AL 25·2, PL 39·7±3·4, Sens. 39·2 with head 11/22.

Schön. (*Ascoschön.*) *audyi* sp. n.

Scutum almost as long as wide between PL. Only one pair of setae between coxae III. DS 22, arranged 2.6.6.4.2.2.

AW 35·9±4·8, PW 64·8±4·8, SB 22·0±2·4, ASB 22·4, PSB 35·2, SD 57·6, A–P 41·6, AM 25·0, AL 12·8, PL 38·4, Sens. 35·2. *Schön.* (*Ascoschön.*) *rattus* (Wom. and Heasp. 1943).

50. DS 22, arranged 2.6.6.4.2.2.

AW 40·0, 38·4, PW 60·8, 61·8, SB 19·2, 22·4, ASB 19·2, 19·2, PSB 22·4, 22·4, 22·4, SD 41·6, 41·6, A–P 22·4, 22·4, AM 36·0, AL 25·0, PL 37·5, Sens. 32·0 with head 23·0/9·5. (AM, and AL after Gunther). *Schön.* (*Ascoschön.*) *lorius* (Gunther 1939).

DS more numerous 51

51. Scutum smaller, DS 34 arranged 4(2).6(8).6.6.6.4.2. i.e. 2nd from middle of second row situated forward in line with humeral setae.

AW 38·4±5·1, PW 54·0±5·7, SB 20·5±3·8, ASB 22·2±2·8, PSB 19·5±10·8, SD 42·3±3·0, A–P 26·7±5·3, AM 24·6±5·2, AL 18·8±3·7, PL 31·1±4·2, Sens. 31·1±4·8.

Schön. (*Ascoschön.*) *indica* (Hirst 1915).
= *Trombicula muris* Walch 1922.
= *Neoschöngastia cockingsi* Radford 1946.

Scutum larger. DS ca. 42 in number, arranged 2.10.8.6.6.6.4, the second row somewhat variable from 8 to 10, but always in more or less the same line.

AW 47·15±4·9, PW 64·1±8·5, SB 24·4±4·5, ASB 24·9±2·9, PSB 19·6, SD 44·1±3·0, A–P 25·5±3·0, AM 27·2±5·7, AL 20·1 ±3·3, PL 33·8±4·9, Sens. 34·7±5·1.

Schön. (*Ascoschön.*) *soekaboemiensis* (Takekawa 1945).

52. Sensillae bases distinctly posterior of line of PL, and PL nearer to AL than to posterior margin 53

Sensillae bases in line with or anterior of line of PL, or if slightly posterior of PL then A–P ca. equal to or greater than PSB 58

53. Scutum widest posterior of line of PL, and PL placed nearer to AL than to the well rounded postero-lateral corners. Palpal claw trifurcate; setae on femur, genu and tibia all branched or ciliated. Galeal setae nude. DS ca, 80, to 50μ long, and arranged 2.12.12.12.12. plus ca. 30. Ventrally with many setae between coxae III.

AW 63·5±9·4, PW 78·7±8·9, SB 25·1±4·7, ASB 28·9±4·0, PSB 25·8±3·1, SD 54·7±5·0, A–P 21·9±4·7, AM 48·2±3·9, AL 38·6±8·5, PL 74·3±9·2, Sens. 42·0 with head 14/28.

Schön. (*Ascoschön.*) *perameles* (Wom. 1939).

Scutum widest in line with PL, and PL at the postero-lateral corners. Only 1 pair of setae ventrally between coxae III 54

54. Posterior scutal margin deep and evenly rounded 55

Posterior scutal margin not an even curve, but roughly three-sided .. 57

55. Dorsal setae 16 in number, arranged 2.4.4.4.2, the anterior setae to 95μ long, decreasing posteriorly to 40–45μ.

AW 65·6±6·6, PW 87·2±5·8, SB 34·4±4·1, ASB 22·4, PSB 28·4±3·2, SD 50·8±3·2, A–P 16·8, AM 53·0, AL 19·6, PL 99·2 ±11·7, Sens. 50·0 with head 11·0 wide.

Schön. (*Ascoschön.*) *similis* (Wom. and Heasp. 1943).

Dorsal setae more numerous 56

56. Dorsal setae 26, arranged 2.6.6.6.4.2.

AW 68·0±4·0, PW 88·75±6·7, SB 34·7±4·3, ASB 25·2, PSB 25·2, SD 50·4, A–P 14·0, AM 52·85±13·05, AL 25·75±6·6, PL 86·25±9·55, Sens. 42·0 with head 16·8/30·8.

Schön. (*Ascoschön.*) *derricki* Wom. 1939.

Dorsal setae 34, arranged 2.8.6.6.6.4.2. Palpal claw trifurcate.

AW 55·6±9·0, PW 65·2±10·5, SB 23·8±4·2, ASB 22·4, PSB 20·4±4·1, SD 42·8±4·1, A–P 14·0, AM 35·6±6·3, AL 21·3 ±3·2, PL 48·0±3·2, Sens. 43·9±4·8 with head 8·4 wide.

Schön. (*Ascoschön.*) *dasycerci* Hirst 1929.

57. Scutal setae long and subequal, with AM slightly shorter than AL and PL the longest. Dorsal setae 2.8.6.6.6.4.2, to ca. 45μ. Palpal claw bifurcate; setae on femur and genu branched; on tibia, ventral branched and dorsal and lateral nude.

AW 61·5, PW 70·0, SB 24·0, ASB 24·0, PSB 16·0, SD 40·0, A–P 16·0, AM 37·5, AL 45·0, PL 56·0, Sens. —. (After Wom. and Heasp. 1943). *Schön.* (*Ascoschön.*) *trichosuri* (Wom. 1939). = *shieldsi* (Gunther 1941).

AL scutal setae very short, and much shorter than AM or PL. Palpal claw trifurcate; all setae on femur, genu and tibia except dorsal tibial branched. Dorsal setae 34, arranged 2.8.6.6.6.4.2, to 70μ long.

AW 68·4±8·2, PW 82·0±6·3, SB 31·6±6·3, ASB 24·8=3·2, PSB 22·4, SD 47·2±3·2, A–P 18·2±3·8, AM 45·2±5·8, AL 25·2±4·8, PL 70·4±3·2, Sens. —.

Schön. (*Ascoschön.*) *hirsti* (Wom. and Heasp. 1943).

58. Sensillae bases about in line with PL 59

Sensillae bases distinctly in front of line of PL 61

59. A–P greater than PSB. Palpal claw trifurcate. Ventral setae on palpal tibia nude. Galeal setae branched. DS 38 arranged 2.6.6.6.6.6 4.2.

AW 71·6±4·9, PW 83·4±5·4, SB 30·0±3·0, ASB 30·0±3·3, PSB 23·6±2·2, SD 53·5±4·9, A–P 30·7±5·0, AM 53·65±4·1, AL 38·4±3·4, PL 63·1±9·1, Sens. 42·6±8·2 with head 12·0 wide.

Schön. (*Ascoschön.*) *phascogale* (Wom. and Heasp. 1943).

A–P ca. equal to PSB 60

60. Palpal claw trifurcate. Ventral seta of palpal tibia branched. Galeal setae branched. DS ca. 34 arranged 2.8.6.6.6.4.2.

AW 82·9±7·4, PW 99·9±7·3, SB 36·1±5·0, ASB 30·4±2·8, PSB 24·8±2·8, SD 55·2±4·6, A–P 26·5±5·2, AM 53·4±8·7, AL 48·1±6·3, PL 79·5±8·0, Sens. 42·0 by 14·0 wide.

Schön. (*Ascoschön.*) *westraliense* (Wom. 1934).

Palpal claw bifurcate. Ventral seta of palpal tibia branched. Galeal setae nude. DS 34 arranged 2.8.6.6.6.4.2.

AW 79·3±4·3, PW 99·2±4·1, SB 35·9±3·4, ASB 30·3±3·4, PSB 20·1±3·4, SD 50·4, A–P 25·2, AM 47·6, AL 40·6±7·0, PL 79·1±4·9, Sens. 44·8 with head 11·2 wide.

Schön. (*Ascoschön.*) *peregrina* sp. n.

61. Dorsal setae situated on small platelets. Leg I 6-segmented 62

Dorsal setae not on platelets. Leg I 7-segmented 63

62. Only the dorsal setae on platelets. Palpal claw trifurcate; setae on palpal femur and genu branched. DS 50 in number, and arranged 2.6.2.6.8.6.4.8.6.4.2, from 27 to 52μ long.

AW 62·0±9·0, PW 78·0±7·0, SB 29·0, ASB 26·7±6·9, PSB 23·7±1·7, SD 50·3±6·2, A–P 36·0±4·2, AM 46·0, AL 33·0, PL 49·0, Sens. 39·3±1·7, with head 13·0 wide.

Schön. (*Ascoschön.*) *heaslipi* (Wom. and Heasp. 1943)

Some of the posterior ventral setae also on platelets. Palpal claw bifurcate; setae on palpal femur and genu nude. DS 30 in number, arranged 2.6.2.6.8.8.4, to 30μ long.

AW 63·0±4·8, PW 75·95±2·1, SB 37·8±4·8, ASB 28·0, PSB 25·0, SD 53·2, A–P 37·8±4·8, AM 42·0, AL 34·8±4·5, PL 22·4, Sens. 47·6 with head 6·0 wide. *Schön.* (*Ascoschön.*) *traubi* sp. n.

63. Dorsal setae 80 in number, arranged 2.12.12.12.12.10.8.6.4.2.

AW 77·6±6·2, PW 97·2±7·3, SB 31·4±2·8, ASB 30·1±6·7, PSB 27·1±5·8, SD 57·2±9·7, A–P 32·2±5·9, AM 57·0±9·5, AL 39·7±4·0, PL 67·2±5·0, Sens. 51·8±3·5, with head 12·0 wide. *Schön.* (*Ascoschön.*) *lawrencei* n. nov. for *guntheri* Wom. & Heasp. 1943, preoc.

Dorsal setae fewer than 50 in number 64

64. Sens. bases nearer to anterior than to posterior scutal margin. AL the shortest and very short. A–P greater than PSB.

AW 74·6±5·7, PW 102·3±4·4, SB 45·6±5·4, ASB 31·3±3·4, PSB 41·0±4·2, SD 72·3±6·3, A–P 45·3±7·3, AM 43·2±4·5, AL 24·1±4·3, PL 51·2±5·4, Sens. 44·8 with head 16·8 wide. *Schön.* (*Ascoschön.*) *wongabelensis* sp. n.

Sens. bases ca. midway between anterior and posterior scutal margins. AL the shortest but not very short 65

65. Dorsal setae 46 in number, arranged 2.8.8.8.8.6.4.2. Scutum deep behind PL. A–P ca. equal to PSB. Galeal setae branched.

AW 70·0, PW 81·0, SB 27·0, ASB 30·0, PSB 24·0, SD 54·0, A–P 29·7±7·6, AM 53·0±6·0, AL 34·7±9·1, PL 63·0±3·0, Sens. 43·0. *Schön.* (*Ascoschön.*) *smithi* (Wom. 1939).

Dorsal setae 28 to 32 in number. Galeal setae nude 66

66. Dorsal setae 28 in number, arranged 2.8.6.6.4.2. Scutum evenly curved behind PL, with A–P slightly less than PSB. Palpal claw bifurcate.

AW 62·3±4·2, PW 86·1±4·2, SB 30·8, ASB 25·2, PSB 25·2, SD 50·4, A–P 23·8±4·8, AM 39·2±6·8, AL 27·1±4·8, PL 41·3 ±8·1, Sens. 47·6 with head 8·4 wide. *Schön.* (*Ascoschön.*) *raui* sp. n.

Dorsal setae 32 in number, arranged 2.6.6.6.6.4.2. Scutum medially flattened or lightly concave behind PL, with A–P greater than PSB. Palpal claw trifurcate.

AW 56·2±7·4, PW 82·8±14·7, SB 29·5±6·3, ASB 29·5±4·4, PSB 20·2±2·38, SD 49·7±6·2, A–P 33·7±6·8, AM 40·9±5·3, AL 31·2±6·7, PL 51·25±8·3, Sens. 37·5±9·5, with head 14·0 wide. *Schön.* (*Ascoschön.*) *cairnsensis* (Wom. and Heasp. 1943).

AW 56·2±1·05, PW 99·7±28·2, SB 35·8±3·8, ASB 31·9±4·6, PSB 25·2, SD 57·1±4·6, A–P 39·2±10·2, AM 42·7±8·0, AL 31·2±3·8, PL 55·3±15·9, Sens. 39·2 with head 14·0 wide. *Schön.* (*Ascoschön.*) *cairnsensis* v. *gateri* (Wom. and Heasp. 1943).

Genus RADFORDIANA nov.

As in *Schöngastia* s. str. but with the chelicerae unusually long, serrated, and almost styliform, and the hypostome long and tongue-like. The palpi are long and slender with the tibial claw simple.

Genotype *Radfordiana rostrata* sp. n.

RADFORDIANA ROSTRATA sp. n.

Plate 66, fig. A–E.

Description of Larvae. Shape broadly oval. Length (unengorged) 300μ, width 215μ. Scutum as figured with anterior margin only indistinctly sinuous between AL; PL nearer to AL than to posterior margin which is deep and broadly rounded behind line of PL; sensillae globose, only indistinctly villous and placed behind PL; scutal setae long, slender and ciliated, with AL the longest. Eyes 2 + 2, posterior the smaller. Chelicerae very long and slender, almost styliform, to 115μ long, with ca. 10–12 fine teeth on distal half of inner margin. Hypostome long and tongue-like, with the galeal setae nude. Palpi long and slender, tibial claw simple; setae on femur and genu shortly but thickly ciliated; on tibia ventral only shortly branched, dorsal and lateral nude; tarsi with pronounced subapical spine-like seta, sub-basal sensory rod, and 4–5 fine slender ciliated setae.

Dorsal setae stout, strongly ciliated, to 40μ, 38 in number, and arranged 2.8.8.8.6.4.2. Ventrally with a pair of branched setae on maxillae, one ciliated seta on each coxa, a pair between coxae I and between coxae III, and thereafter 6.6.6.2.2.2, to 30μ long. Legs: I 360μ long, II 305μ, III 335μ; tarsi I and II with the usual sensory rod, III with a long outstanding nude seta.

The Standard Data for the type and one paratype from scrub, at Lae, New Guinea, April, 1944 (R. N. McCulloch), six specimens from mound of a bush turkey (*Megapodius*) at Dobodura, N.G., June, 1944 (G. M. Kohls), and 4 specimens from an "armed lizard", Hollandia, Dutch N.G., Nov., 1944 (C. B. Philip) are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	61·4±0·88	3·03±0·62	52·3–70·5	56·0–64·4	5·0
PW	87·7±1·21	4·19±0·86	75·1–100·3	78·4–95·2	4·8
SB	24·7±0·47	1·62±0·33	19·9–29·5	22·4–28·0	6·5
ASB	40·8±0·60	2·06±0·42	34·6–47·0	36·4–42·0	5·0
PSB	30·8	No variation recorded			
SD	71·6±0·55	1·87±0·38	66·0–77·2	67·2–72·8	2·6
A–P	30·1±0·61	2·11±0·43	23·8–36·4	25·2–33·6	7·0
AM	46·8±1·02	3·37±0·72	36·7–56·9	42·0–50·4	7·2
AL	69·8±0·80	2·79±0·57	61·4–78·2	64·4–72·8	4·0
PL	56·6±1·00	3·46±0·70	46·2–67·0	50·4–61·6	6·0
Sens.	42·0 with head 16·8/22·4. No variation recorded.				

Remarks. It is possible that *Radfordiana* may not stand as more than a subgenus of *Schöngastia* s. str. but it is so distinct that until the nymphs or adults are known it should be kept at the generic level.

Genus OENOSCHOENGASTIA Wom. and Kohls 1947.

Trans. Roy. Soc. S. Aust., 1947, 71, (1), 8–9.

Allied to *Schöngastia* but the chelicerae are short, curved and stumpy with the apex divided into two terminal blunt and thick teeth, with a pair (sometimes three) of rather smaller teeth subapically. Palpal claw short and stout, trifurcate. Median tarsal claw (empodium) longer than the laterals but equally thick. Sensillae clavate or capitate.

Genotype *Oenoschöngastia cana* Wom. and Kohls 1947.

The nymphal and adult stages of this species are so far unknown. Until such times its relationships to the genus *Schöngastia* are uncertain, but in view of the unique characters of the larvae its retention as a distinct genus is necessary.

OENOSCHÖNGASTIA CANA Wom. and Kohls 1947.

Oenoschöngastia cana Womersley and Kohls 1947, Tr. Roy. Soc. S. Aust., 71, (1), 8–9.

Plate 66, fig. F–J.

Description of Larvae. Shape an elongate oval. Length (unfed) 252μ, width 162μ. Dorsal scutum roughly hexagonal with indistinct and fine pitting; with the usual five normal ciliated setae, of which AL are the longest and AM the shortest, AM with short branches, AL and PL with long outstanding branches; sensillae broadly clavate, the head indistinctly and very shortly setulose, sensillae bases about in line with PL; anterior scutal margin convex, posterior laterally angular. Eyes 2 + 2, large, on well-developed ocular shields and closely adjacent to scutum, posterior eyes the smaller. Chelicerae of peculiar form, short, stout and curved, apex truncate and divided into two strong, broad and blunt teeth, and two (sometimes three) smaller teeth placed subapically on the inner edge. Galeal setae nude. Palpi stout, tibial claw short, stout and trifurcate; femur with a long strong seta with long branches; genu with a nude seta; tibia with the dorsal and lateral setae nude, ventral branched; tarsi short with basal and subapical sensory rods and three or four ciliated or branched setae. Dorsal setae strong with strong ciliations, 36 in number and arranged 2.8.10.6.6.4, to 40–50μ long. Ventrally with the usual pair of branched setae on gnathosoma, a single seta on each coxa, a pair between coxae I and between coxae III, and thereafter 6.6.6.4.2, more slender and with

longer ciliations than the dorsal setae, to 30μ long. Legs: I 324μ long, II 252μ, III 380μ; tarsi I and II with the usual dorsal rod-like setae, tarsi III with a long outstanding nude seta; median claw (empodium) longer than but as thick as the laterals.

The Standard Data in microns derived from 22 specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	62·85±0·56	2·65±0·40	54·9–70·8	60·0–69·0	4·2
PW	78·7±0·71	3·34±0·50	68·7–88·7	75·0–87·0	4·2
SB	31·85±0·49	2·30±0·35	24·95–38·75	30·0–39·0	7·2
ASB	28·9±0·33	1·53±0·23	24·3–33·5	27·0–32·0	5·3
PSB	23·8±0·30	1·38±0·21	19·6–28·0	21·0–27·0	5·8
SD	52·8±0·45	2·11±0·32	46·5–59·1	48·0–57·0	4·0
A–P	29·2±0·32	1·50±0·23	24·7–33·7	27·0–33·0	5·2
AM	32·45±0·46	2·15±0·32	26·0–38·9	27·0–36·0	6·6
AL	74·3±0·50	2·34±0·35	67·3–81·3	70·0–80·0	3·0
PL	59·5±0·39	1·84±0·28	54·0–65·0	55·0–65·0	3·1
Sens.	36·0 with head 20/24.				

Loc. The type and 72 paratypes from the mound of a brush turkey, Dobodura, New Guinea, 18 May, 1944 (G.M.K., No. 325).

The type and 22 paratypes deposited in the South Australian Museum, 35 paratypes in the collection of the Rocky Mountain Laboratory, five paratypes in the U.S. National Museum and five in the British Museum.

Genus GUNTHERANA Wom. and Heasp. 1943.

Guntherana Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 132, *nom. nov.* for *Guntheria* Womersley 1939, *ibid,* 63, (2), 157 (preoc.).

Larval diagnosis. Body form (unengorged) oval, (engorged) elongate oval with a distinct medial constriction. Posteriorly with an area which, when engorged or under pressure, consists of two semicircular plates, opposed in the medial longitudinal line, strongly punctate, and each bearing 3 fine setae; apically the junction of these plates is slightly incised. In unengorged larvae the two plates frequently appear as one large transversely oval plate. Anterior dorsal scutum roughly rectangular, with 5 normal ciliated setae and a pair of globose or capitate, indistinctly villous sensillae. Eyes 2 + 2. Chelicerae nonserrate with only the apical tricuspid cap. Galeal setae nude. Palpi stout, tibial claw trifurcate. All coxae 1-setose. Legs III without any long nude seta on tarsi.

Adult and *Nymph* (see Adult Section of Paper).

Genotype *Neoschöngastia bipygalis* Gunther 1939.

GUNTHERANA BIPYGALIS (Gunther 1939).

Neoschöngastia callipygea Gunther 1938, *nom. nud.*, Med. J. Aust., 2, (6), 202.

Neoschöngastia kallipygos Gunther 1939, *nom. nud.*, Proc. Linn. Soc. New South Wales, 64, (1–2), 83.

Neoschöngastia bipygalis Gunther 1939, Proc. Linn. Soc. New South Wales, 64, (5–6), 471.

Guntheria kallipygos Womersley 1939, Tr. Roy. Soc. S. Aust., 63, (2), 187.

Guntheria bipygalis Gunther 1940, Proc. Linn. Soc. New South Wales, 65, 250; *idem.*, Med. J. Aust., 2, (22), 564–72.

Guntherana bipygalis Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 109.

Guntherana parana, Womersley 1944, Tr. Roy. Soc. S. Aust., 68, (1), 106.

Plate 67, fig. A–H.

This species was originally described from specimens from *Rattus browni* Alston, *R. ringens* Peters and Doris, *R. mordax* Thomas, *Melomys moncktoni* Thomas, *M. stalkeri* Thomas, *M. rubex* Thomas, *M.* sp., *Echymipera cockerelli* Ramsay, and *Peroryctes raffrayana* Milne Edwards from New Guinea by Gunther. Although Gunther later (1939, 64 (5–6)), figured the young larva within the ovum, his original description and figures were from free and engorged larvae. Although Gunther states (*loc. cit.* 471) that "specimens (larvae) also have been taken running free in the fur" he does not say whether these are engorged or not.

In 1939 Womersley recorded the species from engorged specimens from Queensland from *R. culmorum youngi* Thomas and from *Isoodon torosus* Ramsay.

Guntherana parana was described in 1944 by Womersley from unengorged larvae collected on boots at Abidari and Buna by R. N. McCulloch. These larvae were considered as distinct from *bipygalis* Gunther, on the smaller Standard Data, the lack of a medial constriction, and the larger number of dorsal and ventral setae. In other generic features such as the posterior dorsal shield, (or pair of shields) and the two very long dorsal setae just anterior of the dorsal shield, they fitted well into the genus.

Gunther's original description and figure of the dorsal surface show the dorsal setae as 2.6 (2 or 4). 4.2.4.2./6./2, i.e. 28 (30 or 32). Actually there are

only 26, the last 2 strictly belonging to the ventral surface. The six posterior setae are the fine setae on the paired posterior dorsal plates, while the next pair are the very long closely adjacent setae just in front of the posterior plates. In *parana* the dorsal setae are 26, arranged 2.6.4.6(4).2(4), plus 6 fine setae on the posterior plates.

Ventrally for *bipygalis,* Gunther gives the setae posterior of coxae III as 4.2./4.4 or 14 in all. A careful examination of his type larva (engorged) in the South Australian Museum, shows however, that there are more setae than Gunther saw, namely 24, arranged ca. 6.6./6.4.2. Probably some of the setae had been rubbed off and not observed by Gunther. This is the case with other specimens which I have examined. The setae bases can, however, be usually traced. This larger number of ventral setae is the same as in *parana,* so that the only difference left between this species and *bipygalis* is the somewhat smaller scutum and the lack of the medial constriction. As the constriction may be a result of engorgement, (although it is just indicated in Gunther's figure of the unhatched larva), it would appear best to regard *parana* as a possibly local population of *bipygalis* differing only in the lower Standard Data.

It should be noted, however, that Gunther's finding of the eggs of *bipygalis* attached to the hairs of the host suggests that the young larvae before attachment for feeding, may be free living in the fur and not on the ground. Yet the specimens described earlier as *parana* as well as other unengorged larvae from New Guinea and Queensland, which on Standard Data agree more with typical *bipygalis,* were collected on boots. This is a point which needs further investigation, especially in regard to affording confirmation of Gunther's observations.

The nymph and adults of this species are described in the Adult Section of this paper, and the genus in those stages defined. The nymph was reared from engorged larvae. The adult was correlated with larvae reared therefrom, and which at the time were regarded as *parana.*

Of the material in the South Australian Museum (32 specimens of larvae), there is a high degree of variation in the Standard Data, and in the length of the pair of long setae just in front of the posterior dorsal plates.

In the Standard Data the 7 specimens of unengorged larvae from Abidari and Buna, New Guinea, collected by R. N. McCulloch 1943, the data for AW, PW, SB, ASB, PSB, SD and A–P are significantly lower, and there is comparatively little variation in PL.

The Standard Data for these specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	47·2±0·73	1·93±0·52	41·4–53·0	44·8–50·4	4·1
PW	65·2±0·52	1·37±0·36	61·1–69·3	64·5–67·2	2·1
SB	16·8	No variation recorded			
ASB	23·2±0·52	1·37±0·36	19·1–27·3	22·4–25·2	5·9
PSB	11·2	No variation recorded			
SD	34·4±0·52	1·37±0·36	30·3–38·5	33·6–36·4	4·0
A–P	28·0	No variation recorded			
AM	33·6	No variation recorded			
AL	69·6±0·91	2·52±0·67	62·1–77·1	64·4–72·8	3·6
PL	95·6±1·28	3·40±0·91	85·4–105·8	89·6–98·0	3·6
Sens.	33·6 with head 16·8/19·6. No variation recorded.				

The Australian material from Queensland, plus the type and one paratype from Bulolo, New Guinea, show distinctly larger Standard Data, and the values as given by Womersley and Heaslip (1943) treated statistically are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	57·5±0·95	4·12±0·67	45·1–69·9	47·0–65·0	7·2
PW	77·85±1·54	6·72±1·09	57·7–98·0	68·0–92·0	8·6
SB	19·75±0·41	1·78±0·29	14·4–25·1	17·0–23·5	9·0
ASB	23·5±0·28	1·18±0·19	20·0–27·0	21·0–26·0	5·0
PSB	12·8±0·24	1·01±0·17	9·8–15·8	11·0–16·0	8·0
SD	36·45±0·42	1·80±0·30	31·05–41·85	33·0–42·0	4·9
A–P	28·8±0·58	2·44±0·41	21·5–36·1	26·0–34·0	8·5
AM	32·0±0·46	1·66±0·32	27·0–37·0	30·0–34·0	5·0
AL	73·3±0·96	3·84±0·68	61·8–84·8	64·0–77·0	5·2
PL	97·2±1·66	6·86±1·18	76·6–117·8	80·0–113·0	7·0
Sens.	31·0 with head 15·0 wide.				

Genus NEOSCHOENGASTIA Ewing 1929.

Manual of External Parasites 1929, 187. Genotype *Schöngastia americana* Hirst 1921, Ann. Mag. Nat. Hist., (9), 7, 37, (larvae).

= *Paraschöngastia* Womersley 1939, Tr. Roy. Soc. S. Aust., 63, (2), 165 Womersley and Heaslip 1943 *ibid.*, 67, (1), 129, (larvae).

Neoschöngastia Wharton and Hardcastle 1946, J. Parasit., 32, (3), 286–322, (larvae and nymphs).

Ewing erected this genus for Hirst's *Schöngastia americana* principally on the chelicerae not being serrate on the inner (dorsal) margin but also on the palpal claw being trifurcate and the dorsal scutum being "poorly chitinized and tending to break up into smaller platelets". Hirst in his description of

americana (*loc. cit.*) says, "Scutum not so definite in shape as in known species of *Schöngastia,* being weakly chitinized; posteriorly it is interrupted in the middle, being practically divided into two portions or wings by a series of (median) longitudinal parallel striations".

Although no figure was published with the original description, a very excellent one showing the above peculiar structure of the dorsal scutum is shown in the pamphlet "Mites Injurious to Domestic Animals," by Hirst (B.M. (N.H.) Econ. Ser. No. 13. 1922, p. 60).

Although Ewing, as stated above, notes the peculiar scutal structure, he evidently did not regard it as of much generic importance, for in his later publications he included in *Neoschöngastia* many species with non-serrate chelicerae but with a normal scutum; particularly did he do so in his key to the larval genera of the Trombiculinae of 1938 (J. Wash. Acad. Sci., 28, (6)).

In 1939 Womersley recognized two groups within the genus *Neoschöngastia* Ewing, and separated off those New Guinea species of Gunther's, in which the scutum had a "distinct raised crest in front of the pseudostigma" which "forms a very distinct wall in which the bases of the sensillary hairs are situated", and "the posterior half of the scutum on each half has circular striations but the anterior half is pitted", as a new genus *Paraschöngastia.* Later 1943, Womersley and Heaslip designated *Neoschöngastia yeomansi* Gunther 1939, as type of *Paraschöngastia.*

At the time, however, it was not recognized that these characters were also those of *N. americana* and it was only in 1946 that Ewing recognized that *N. americana* and *P. yeomansi* were congeneric. The present writer is in full agreement with this, and accepts *Paraschöngastia* as a synonym of *Neoschöngastia.*

This position leaves all those species with a normal scutum and non-serrate chelicerae hitherto placed by Ewing and by Womersley and Heaslip 1943, etc., in *Neoschöngastia,* in need of a new generic name, for which Ewing 1946 has proposed *Ascoschöngastia* with *Neoschöngastia malayensis* Gater as the type species. Wharton 1946, in recently discussing the genus *Neoschöngastia* has further stressed the striations on the dorsal scutum as being of generic importance. He points out that these striations are those of the dorsal cuticle, the posterior portion of the scutum being overlapped by the cuticle. This overlapping, however, is not confined to the genus *Neoschöngastia.* As instanced in the present paper, it also occurs in a few species of *Schöngastia* (*Ascoschöngastia*), but here the striations are transverse, whereas in *Neoschöngastia* they are more or less circular and thus differentiated from the normal dorsal striations.

NEOSCHÖNGASTIA BOUGAINVILLENSIS Wharton and Hardcastle 1946.

J. Parasitol., 1946, 32, (3), 296 fig. (larva).

Plate 74, fig. E.

This species was described from *Hirundo tahitica* from Bougainville, July, 1944, and from *Anous stolidus* and *Heterocelus incanus* from Guam, May and September respectively, 1945. It is differentiated from all other species by the peculiar rounded elevation on the basal segment of the chelicerae and by the broadly clavate sensillae fitting into a well marked pair of pits posterior of the sensillae bases.

The galeal setae are nude, and on the palpi the femoral and genual setae are strongly branched; the tibia with the dorsal seta nude, the lateral nude or with an indistinct branch, the ventral distinctly branched. The scutum is as figured (after Wharton and Hardcastle) with the lateral margins strongly concave and the posterior margin moderately shallow but concave medially. The DS are ca. 90 in number and from 37μ long anteriorly to 33μ posteriorly, in rather indefinite rows. All coxae unisetose. Ventral setae 10–30μ long, about 80 in number posterior of coxae III. Tarsus III without any long nude seta.

The Standard Data from Wharton and Hardcastle's data for 4 specimens treated statistically are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	58·75±1·75	3·50±1·24	48·25–69·25	55·0–63·0	6·0
PW	87·75±1·93	3·86±1·36	76·2–99·3	84·0–92·0	4·4
SB	29·25±1·11	2·22±0·78	22·6–35·9	27·0–32·0	7·5
ASB	29·75±0·63	1·26±0·44	25·95–33·55	28·0–31·0	4·2
PSB	26·0±1·18	3·37±1·68	15·9–36·1	24·0–31·0	12·9
SD	55·75±1·18	2·36±0·83	48·05–62·85	54·0–59·0	4·2
A–P	41·75±2·01	4·03±1·42	29·65–53·85	36·0–45·0	9·6
AM	60·75±1·65	3·30±1·17	50·35–70·15	56·0–64·0	5·5
AL	60·5±0·29	0·57±0·20	58·8–62·2	60·0–61·0	0·95
PL	60·25±0·25	0·50±0·25	58·75–61·75	60·0–61·0	0·8
Sens.	35·5±0·96	1·91±0·68	29·8–41·2	34·0–38·0	5·4

NEOSCHÖNGASTIA STRONGI Wharton and Hardcastle 1946.

J. Parasitol., 1946, 32 (3), fig. (larva).

Plate 75, fig. E.

Described from larvae from *Numenius phaeopus* from Guam, July, 1945, and from *Arenaria interpres* from Peleliu, September, 1945. Distinguished

from all other species by the nude seta on the palpal genu, the relative closeness of the sensillae bases and the sensillae themselves lying in depressions anterior of the sensillae bases. Galeal setae nude, as are also the dorsal and lateral setae of the palpal tibia.

The dorsal setae are from 35μ to 17μ long, with a pair of humeral setae plus ca. 70 in irregular rows. Coxae III unisetose. Tarsus of leg III with a long nude seta.

The Standard Data given by Wharton and Hardcastle for 3 specimens, treated statistically are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	40·0±1·0	1·73±0·71	34·8–45·2	39·0–42·0	4·3
PW	65·3±1·2	2·08±0·85	59·1–71·5	63·0–67·0	3·2
SB	13·0±1·15	2·00±0·82	7·0–19·0	11·0–15·0	15·4
ASB	33·7±0·67	1·15±0·47	30·2–37·2	33·0–35·0	3·4
PSB	14·3±0·67	1·15±0·47	10·8–17·8	13·0–15·0	8·0
SD	48·0±1·15	2·0±0·82	42·0–54·0	46·0–50·0	4·2
A–P	34·3±0·88	1·53±0·62	29·7–38·9	33·0–36·0	4·4
AM	24·3±1·45	2·52±1·03	16·8–31·8	22·0–27·0	10·3
AL	36·7±1·20	2·08±0·85	30·5–39·0	35·0–39·0	5·7
PL	38·7±3·18	5·51±2·25	22·2–55·2	35·0–45·0	14·2
Sens.	21·5±0·5	0·71±0·35	19·4–23·6	21·0–22·0	3·3

NEOSCHÖNGASTIA MONTICOLA Wharton and Hardcastle 1946.

J. Parasitol., 1946, 32, (3), 301, fig. (larva).

Plate 75, fig. D.

Described from *Monticola solitarius* from Okinawa, from June to August, 1945.

In this species the form of the sensillae is unusual for this genus, these being very long with a long and clavate attenuated head, furnished with long fine setules. The scutum is as refigured here, after Wharton and Hardcastle, with PL very much longer than AM or AL. The galeal setae are short and nude. On the palpi the femoral and genual setae are branched as is the ventral tibial; the dorsal and lateral tibial setae are nude.

The DS setae number 38 to 40, are from 62μ to 39μ long, and arranged ca. 2.8.6.6.6.6.4.2. All coxae unisetose, only 2 sternal setae and posterior of coxae III about 50 setae. A nude long seta on tarsi III.

The Standard Data, treated statistically for the measurements of 5 specimens given by Wharton and Hardcastle are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	55·8±1·2	2·68±0·85	47·8–63·8	54·0–60·0	4·8
PW	77·8±2·0	4·38±1·38	64·7–90·9	72·0–82·0	5·6
SB	32·4±0·82	1·83±0·82	26·9–37·9	30·0–34·0	5·7
ASB	24·6±0·60	1·34±0·42	20·6–28·6	24·0–27·0	5·4
PSB	26·4±1·25	2·79±0·88	18·0–34·8	24·0–31·0	10·6
SD	51·0±1·82	4·06±1·28	38·8–63·2	48·0–58·0	7·9
A–P	27·2±0·20	0·45±0·14	25·9–28·5	27·0–28·0	1·6
AM	42·6±2·77	6·19±1·96	24·1–61·1	36·0–49·0	14·5
AL	35·0±0·83	1·87±0·59	29·4–40·6	33·0–37·0	5·3
PL	75·2±2·80	6·26±1·98	56·4–94·0	66·0–82·0	8·3
Sens.	70·75±2·80	5·68±2·01	53·75–87·75	63·0–75·0	8·0

NEOSCHÖNGASTIA POSEKANYI Wharton and Hardcastle 1946.

J. Parasitol., 1946, 32, (3), 302, fig. (larva).

Plate 75, fig. A.

Described from *Monticola solitarius* and *Streptopelia orientalis* from Okinawa, May and July, 1945.

This species can be distinguished as in the key. As stated by the above authors it is close to *gallinarum* but can be at once distinguished by the long nude seta on tarsi III.

The dorsal scutum is roughly rectangular and rather long, with the margins lightly sinuous; AM is much stronger and with longer branches than AL or PL, but shorter than these. The sensillae are globular with the tip rather truncate, and their bases much nearer to AL than to PL.

The galeal setae are nude, and on the palpal femur, genu and tibia only the dorsal tibial is nude. All coxae unisetose. The dorsal setae number 34, from 52μ to 43μ long, and are arranged 2.8.6.8.4.2.2.2. Posterior of coxae III the ventral setae are 6.6.2.6.2.2.

The Standard Data, treated statistically from 5 specimens, quoted by Wharton and Hardcastle are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	75·2±1·46	3·27±1·03	65·4–85·0	70·0–78·0	4·3
PW	79·8±1·33	2·97±0·94	70·9–88·7	77·0–84·0	3·7
SB	47·4±1·36	3·05±0·96	38·3–56·5	45·0–52·0	6·4
ASB	25·4±1·03	2·30±0·73	18·5–32·3	22·0–27·0	9·0
PSB	33·6±1·17	2·61±0·82	25·8–41·4	29·0–35·0	7·7
SD	59·0±1·34	3·00±0·95	50·0–68·0	56·0–63·0	5·1
A–P	29·4±0·68	1·51±0·48	24·9–33·9	28·0–31·0	5·1
AM	49·0±1·14	2·55±0·81	41·4–56·6	45·0–52·0	5·2
AL	74·8±4·42	9·88±3·12	45·2–104·4	66·0–91·0	13·2
PL	52·4±1·57	3·51±1·11	41·9–62·9	49·0–56·0	6·7
Sens.	29·75±1·61	3·59±1·13	18·95–40·55	27·0–35·0	12·0

NEOSCHÖNGASTIA GALLINARUM (Hatori 1920).

Trombicula gallinarum Hatori 1920. Taiwan Igakkai Zasshi, No. 209, pl. II, fig. 1–6; Kawamura and Yamaguchi 1921, Kitasato Archiv, Exper. Med. 4, 169; Fletcher, Lessler and Lewthwaite 1928, Tr. Roy. Soc. Trop. Med. Hyg., 22, 161.

Neoschöngastia gallinarum, Sugimoto, 1936, J. Jap. Soc. Veterinary Sci., 15, 201; Wharton and Hardcastle, 1946, J. Parasitology, 32, (3), 292.

Paraschöngastia gallinarum, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 130.

Schöngastia gallinarum, 1947, Sig Thor and Willmann, Das Tierreich, 71b, 394.

Plate 69, fig. A–E.

This specific name was attributed by Kawamura and Yamaguchi to Hatori for a "red mite" from fowls in Formosa. At the time of publishing their paper in 1943, Womersley and Heaslip had been unable to find any reference to the use of this specific name, or of any figures or description by Hatori, and therefore gave Kawamura and Yamaguchi as the author. Sugimoto, 1936, in his paper gives the above reference to Hatori's paper which appears to have contained figures and description. I have, however, not been able to obtain Hatori's paper, but from the evidence it appears that *gallinarum* must be attributed to Hatori himself.

Sugimoto (1936) described and figured the larvae also from Formosa.

Fletcher *et al.* (1938) referred to a "red mite" of fowls and other birds from the Federated Malay States, but did not give a description and only figured the dorsum and dorsal scutum. Their figures, however, compared with those of Kawamura and Yamaguchi and of Sugimoto are not very convincing as to the identification. Kawamura and Yamaguchi gave the following details of the larvae: scutal length 42μ, scutal width 65·1μ, sensillae 22·5μ long with head 14·5 $\times$ 14·5μ and strongly ciliated; DS 33μ long and arranged 14.10.6.8.6 (i.e. 44 in number).

From their figure, however, the DS are 2.11.9.8.6.2 or 38 in number. Sugimoto shows them as 2.10.8.8.6.6.2 or 42 in number.

The Standard Data computed from Kawamura and Yamaguchi's figures and data in 1943 by Womersley and Heaslip were: AW 52·0, PW 60·0, SB 35·0, ASB 16·5, PSB 26·5, SD 43·0, A–P 31·0, AM 32·0, AL 35·0, PL 50·0, Sens. 22·5 with head 14·5/14·5.

Fletcher *et al.* 1938 give the DS as 2.12.10.8.6.4.2 (=44) and from their figures the Standard Data were computed (1943) as: AW 52·0, PW 60·0, SB 42·0, ASB 19·0, PSB 26·0, SD 45·0, A–P 30·0, AM 34·0, AL 35·0, PL 33·0, Sens. 26·0.

This species was placed by Womersley and Heaslip 1943 in *Paraschöngastia* (= *Neoschöngastia*) on the presence of the pronounced transverse crest from which the sensillae arise. None of the figures extant, however, shows the typical cuticular striations of this genus.

The type and 19 paratypes are stated by Sugimoto (1936) to be in the Taihoku Imperial University Museum, Taihoku.

Recently at my request, Dr. J. R. Audy has recovered this species from fowls at Kuala Lumpur, F.M.S., and from 4 specimens sent to me, the following redescription and figures are given. These specimens agree very well with the details and figures given by Fletcher *et al.* 1928, Kawamurra and Yamaguchi 1921, Sugimoto 1936, and Hatori 1920. There is no doubt but that the Kuala Lumpur specimens are identical with Hatori's Formosan material.

Re-description of Larvae. Shape broadly oval, widest anterior of the middle. Length (engorged) to 390μ, width to 320μ. Scutum rather small, somewhat trapezoidal, with sensillae wide apart in a distinct crest and placed nearer to line of AL than to PL; AM scutal seta the shortest, AL and PL subequal with PL slightly the shorter; sensillae globose and setulose; posterior half with semicircular striations, anterior half punctate. Eyes well developed, on ocular shields; posterior eyes the smaller. Chelicerae simple with only the apical tricuspid cap, and an inner subapical forwardly directed tooth. Palpi with trifurcate tibial claw; setae on femur, genu and tibia all ciliated or branched. Galeal setae ? nude. Dorsal setae 46 in number, arranged 2.10.8.6.8.6.4.2, to 33μ long. Ventrally with paired branched setae on maxillae, a pair between coxae I and between coxae III, a single fine and short ciliated seta on each coxa, and behind coxae III 40 setae, arranged 8.8.6.4.6.6.2, to 30μ long. Legs: I 240μ long, II 200μ, III 227μ; tarsi I and II with usual dorsal sensory rod, III with a long nude seta.

The Standard Data derived from the 4 recent specimens from Kuala Lumpur are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	55·3±0·70	1·40±0·49	51·1–59·5	53·2–56·0	2·5
PW	67·9±0·70	1·40±0·49	63·7–72·1	67·2–70·0	2·0
SB	42·0	No variation recorded			
ASB	19·6	No variation recorded			
PSB	25·2	No variation recorded			
SD	44·8	No variation recorded			
A–P	28·7±0·70	1·40±0·49	24·5–32·9	28·0–30·8	4·9
AM	29·9±0·93	1·61±0·66	25·1–34·7	28·0–30·8	5·4
AL	45·5±0·70	1·40±0·49	41·3–49·7	44·8–47·6	3·1
PL	45·7±1·34	2·69±0·95	37·6–53·8	42·0–47·6	5·9
Sens.	33·6 with head 19·2/22·4. No variation recorded.				

NEOSCHÖNGASTIA BACKHOUSEI Gunther 1939.

Neoschöngastia fournieri Gunther 1938 (*nom. nud.*), Med. J. Aust., 2, 202.

Neoschöngastia backhousei Gunther 1939, Proc. Linn. Soc. New South Wales, 64, (1–2), 89; Wharton and Hardcastle 1946. J. Parasitol., 32, 294.

Paraschöngastia backhousei Womersley 1939, Tr. Roy. Soc. S. Aust., 63, (2), 165; Gunther 1940, Proc. Linn. Soc. New South Wales, 65, (3–4), 252; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 130.

Plate 69, fig. F–J.

No fresh material of this species has been collected since the original discovery. The palpal claw is much more slender than in *yeomansi* and well surpasses the tip of the palpal tarsus. The setae on the palpal femur and genu are well branched but not so much as in *yeomansi*; on the tiiba the ventral seta is branched, the dorsal nude and the lateral one- or two-branched, not nude as stated by Gunther. The chelicerae are probably much as in *yeomansi* and other species, but Gunther's figure is not clear and in the type specimen they are broken off. The galeal setae are short and branched as figured here. On the dorsum the setae are uniform in structure without any specialization posteriorly.

Coxae III is unisetose. Leg III is missing.

The Standard Data as given in 1943 (*loc. cit.*) are: AW 58·0, PW 72·0, SB 48·0, ASB 23·5, PSB 25·0, SD 48·5, A–P 42·0, AM 37·5, AL 47·0, PL 42·0, Sens. 30·0 with head 15/20.

Loc. Bulolo, New Guinea, ex *Megapodius duperreyi* 1939 coll. C. Gunther

NEOSCHÖNGASTIA EGRETTA Wharton and Hardcastle 1946.

J. Parasitol., 1946, 32, (3), 304, fig. (larva).

Plate 74, fig. G.

Described from *Egretta intermedia* from Okinawa, August, 1945, and from *E. intermedia, Demigretta sacra, Anous stolidus* and *Pluvialis dominica* from Ulithi Atoll, August, 1945.

This species differs from *backhousei* Gunther in the posterior dorsal setae not arising from platelets and in lacking the posterior dorsal pitting.

The galeal setae are branched, and the setae on the palpal femur and genu and the ventral on the tibia are branched. The scutum is as figured from Wharton and Hardcastle. The sensillae are globose with rather a thick and

relatively long pedicel and the heads lie in rather ill-defined pits posterior of the sensillae bases, and these pits are surrounded by the cuticular striations.

The dorsal setae range from 45μ to 21μ in length and there are 2 humeral setae followed by 66–74, arranged anteriorly in rows of ca. 10. All coxae unisetose, and posterior of coxae about 64–70 ventral setae. No nude seta on tarsi III.

Wharton and Hardcastle's data for 4 specimens treated statistically are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	65·3±1·67	2·89±1·18	56·6–74·0	62·0–67·0	4·4
PW	73·25±0·72	1·44±0·51	67·95–78·55	72·0–74·0	2·0
SB	53·0±1·06	2·45±0·87	46·7–59·3	50·0–55·0	4·6
ASB	21·75±0·95	1·89±0·67	16·0–27·4	20·0–24·0	8·7
PSB	30·5±1·85	3·70±1·30	19·5–41·5	28·0–36·0	12·1
SD	52·25±2·60	5·19±1·84	36·9–68·1	49·0–60·0	9·9
A–P	31·5±1·26	2·51±0·89	24·0–39·0	29·0–35·0	8·0
AM	27·7±1·76	3·05±1·25	18·6–36·8	25·0–31·0	11·0
AL	57·3±1·33	2·13±0·94	5·04–64·2	56·0–60·0	4·0
PL	37·0±1·22	2·45±0·87	29·7–44·3	35·0–40·0	6·6
Sens.	31·0	Only one measurement.			

NEOSCHÖNGASTIA STRUTHIDIA sp. n.

Paraschöngastia sp., Gill, Moule and Reik, 1945, Aust. Vet. J., 32, fig. (5).

Plate 70, fig. F–J.

Description of Larvae. Shape broadly oval, almost cordate. Length, engorged 450μ, width 330μ. Dorsal scutum as figured with the anterior margin sinuous, convex medially and laterally; posterior margin rather deep, sinuous and concave medially; surface anterior of sensillae bases with large but sparse tuberculations; sensillae globose, apparently nude or with only minute inconspicuous setulations, the bases about midway between lines of AL and PL, situated in the usual transverse crest-like wall; posterior with circular striations. Eyes 2 + 2, with distinct ocular shields, the anterior eye the larger and more prominent. Chelicerae as figured, with the usual apical tricuspid cap, but the forwardly directed subapical inner tooth not as prominent as in other species. Galeal setae short and with a few branches. Palpi stout, tibial claw trifurcate, median prong over-reaching tip of tarsus; setae on femur and genu long and strongly branched; on tibia, dorsal nude, lateral with a few indistinct branches, ventral slender and shortly branched; tarsus with the usual subapical and sub-basal sensory rods and 4 or 5 ciliated setae. Dorsal setae slender and very shortly ciliated, 32 in number and arranged 2.8.6.6.4.4.2,

to 54μ long. Ventrally with the usual pair of branched setae on gnathosoma, one on all coxae, a pair between coxae I and between coxae III and thereafter 6.4.6.4.2.2, to 40μ long. Legs: I 420μ long, II 360μ, III 440μ; tarsi I and II with the usual dorsal rod-like setae, III without a long nude seta, the corresponding setae being shortly but distinctly ciliated; tarsi I without the conspicuous dorsal subapical lobe of *entomyza*.

The Standard Data from the type and 5 paratypes are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	75·5±0·92	2·26±0·65	68·7–82·3	73·0–79·0	3·0
PW	85·0±0·77	1·90±0·55	79·3–92·7	82·0–88·0	2·2
SB	43·0±0·63	1·55±0·45	38·3–47·7	42·0–45·0	3·6
ASB	22·5±0·67	1·64±0·47	17·6–27·4	21·0–24·0	7·3
PSB	30·3±0·36	0·82±0·23	27·9–32·7	30·0–32·0	2·7
SD	52·8±0·89	2·14±0·62	46·4–57·2	51·0–56·0	4·0
A–P	33·0	No variation recorded			
AM	57·6±0·60	1·34±0·42	53·6–61·6	57·0–60·0	2·3
AL	85·8±0·83	2·04±0·59	79·7–91·9	85·0–90·0	2·4
PL	51·75±1·43	2·87±1·01	43·1–60·4	48·0–54·0	5·5
Sens.	32·0 with head 24/24.				

Loc. Described from 6 specimens from an Apostle Bird, *Struthidia cinerea* from Logan Downs, Clermont, Queensland 1944 (D. A. Gill).

Remarks. The slide containing the type and two paratypes is in the McMaster Laboratory, Sydney and another slide of 3 paratypes is in the South Australian Museum collection. I am indebted to Mr. D. A. Gill of the McMaster Laboratory for the opportunity of describing this material.

NEOSCHÖNGASTIA RETROCINCTA Gunther 1939.

Neoschöngastia retrocoronata Gunther 1938 (*nom. nud.*), Med. J. Aust., 2, (6), 202.

Neoschöngastia retrocincta Gunther 1939, Proc. Linn. Soc. New South Wales, 64, (1–2), 87; Wharton and Hardcastle 1946, J. Parasitol, 32, (3), 295.

Paraschöngastia retrocincta, Womersley 1939, Tr. Roy. Soc. S. Aust., 63, (2), 165; Gunther 1940, Proc. Linn. Soc. New South Wales, 65, (3–4), 247; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 131.

Plate 70, fig. A–E.

In this species the palpal claw is trifurcate with the median prong about twice as long as the others and reaching well beyond the tip of the palpal tarsus. The setae on the palpal femur and genu are strongly branched; on

the tibia the ventral seta is strongly branched, the dorsal nude, lateral 2–3 branched; long dorsal seta on palpal tarsus somewhat fasciculate. Chelicerae as in *yeomansi*. Galeal setae 2–3 branched.

Posteriorly on the dorsum and venter is a semicircular area demarcated by a circle of stout, finely serrated spines to 72μ long; inside the area are a number of large, more or less rectangular to round, finely pitted platelets from which arise short, 25μ long, pointed and finely serrate scetae. The dorsal setae are normally ciliated and tapering to 40μ long.

Coxae III are furnished each with 2 setae; tarsus III has not got a long nude seta as stated by Gunther, the corresponding seta being finely but perhaps less ciliated than the others.

The Standard Data for the type and 3 paratypes reported on in 1943 (*loc. cit.*) and 3 specimens from scrub at Lae, New Guinea, 9th April, 1944 (R. N. McCulloch) and 1 specimen from the mound of a bush turkey Dobodura, June 1944 (G .M. Kohls), N.G., are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	71·4±0·70	2·00±0·50	65·4–77·4	70·0–75·0	2·8
PW	84·5±1·35	3·82±0·95	73·1–95·9	80·0–91·0	4·5
SB	55·5±0·71	2·00±0·50	49·5–61·5	54·0–60·0	3·6
ASB	28·0	No variation recorded			
PSB	21·3±0·76	2·01±0·54	15·3–27·3	21·0–25·0	9·4
SD	44·4±0·53	1·39±0·37	40·2–48·6	42·0–46·0	3·1
A–P	35·25±0·25	0·71±0·18	33·15–37·35	34·0–36·0	2·0
AM	36·0	No variation recorded			
AL	72·0±1·07	2·83±0·76	63·6–80·4	70·0–76·0	3·9
PL	51·4±1·49	3·95±1·06	39·7–63·1	44·0–56·0	7·7
Sens.	36·0 with head 20/27.				

NEOSCHÖNGASTIA YEOMANSI Gunther 1939.

Neoschöngastia jamesi Gunther 1939 (*nom. nud.*), Med. J. Aust., 2, 202.

Neoschöngastia yeomansi Gunther 1939, Proc. Linn. Soc. New South Wales, 64, (1–2), 81; nec. Wharton and Hardcastle 1946, J. Parasit., 32, (3), 293.

Paraschöngastia yeomansi Womersley 1939, Tr. Roy. Soc. S. Aust., 63, (2), 166; Gunther 1940, Proc. Linn. Soc. New South Wales, 65, (3–4), 252; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 131.

Plate 71, fig. A–E.

In this species the palpal claw is trifurcate and short and stumpy, with the median and longest prong only slightly over-reaching the apex of the palpal tarsus. The chelicerae are more serrate, with an apical tricuspid cap

of which the ventral tooth is rather pronounced, and on the inner (dorsal) edge with a prominent forwardly directed tooth. The galeal setae are short with 4 or 5 branches. The setae on the palpal femur and genu are long, with long outstanding branches; on the tibia the dorsal and lateral setae are relatively short and nude; the ventral tibial seta is much longer with about 4 long branches; the palpal tarsus carries the usual subapical and sub-basal sensory rods and 5–6 ciliated setae, the longest of which is fasciculate, and overreaches apex of claw. There is no long nude seta on tarsi III as stated by Gunther (a sub-basal long outstanding seta is present but distinctly, though shortly, ciliated).

The dorsal scutum is as figured with AL the longest, and AM the shortest and situated well posterior of line of AL; the sensillae are situated wide apart, about equidistant between lines of AL and PL, globose with very fine villosity, and their bases in a crescentic wall; the anterior half of the scutum is pitted, and the posterior half with circular overlapping striations.

The scutal and anterior dorsal setae are tapering, closely and shortly ciliated. The anterior dorsal setae number approximately 70, followed posteriorly by an area, more or less pitted and carrying about 40 stout spine- or awl-like setae, situated on platelets, and with their margins sparsely serrated; the anterior setae are from 45 to 35μ long, decreasing posteriorly, and the posterior spines to 42μ long.

Coxae I and II are unisetose but III are bisetose. In 7 paratypes in the South Australian Museum, 5 paratypes in the collection of Wharton and Hardcastle, as well as in two specimens from Lae, New Guinea, there is no variation in the setation of coxae III. The setae on coxae I and II are very long.

Ventrally, behind coxae III are about 48 tapering ciliated setae anterior of the anus, and then about 40 serrated spines on platelets as on the dorsum.

The Standard Data for 7 paratypes and two specimens from Lae, N.G., are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	77·15±0·49	1·47±0·35	72·75–81·55	75·6–78·4	1·9
PW	103·1±1·85	5·56±1·31	86·4–119·8	98·0–112·0	5·4
SB	64·1±0·56	1·68±0·39	59·1–69·1	61·6–67·2	2·6
ASB	30·5±0·31	0·93±0·22	27·7–33·3	28·0–30·8	3·0
PSB	28·3±0·31	0·93±0·22	25·5–31·1	28·0–30·8	3·3
SD	58·8±0·47	1·40±0·33	54·6–63·0	56·0–61·6	2·4
A–P	36·4±0·66	1·98±0·47	30·5–42·3	33·6–39·2	5·4
AM	39·2±1·22	3·23±0·86	32·5–45·9	33·6–42·0	8·2
AL	83·1±0·87	2·46±0·62	75·7–90·5	78·4–86·8	3·0
PL	55·6±0·40	1·06±0·28	52·4–58·8	53·2–56·0	1·9
Sens.	39·2 with head 20/28. No variation recorded.				

Loc. and Hosts. From *Megapodius duperreyi* from Bulolo, N.G. (Gunther 1939), and two specimens from Lae, N.G., 9/4/1946 (R. N. McCulloch), collected on boots.

Remarks. In 1946, Wharton and Hardcastle, recorded as *N. yeomansi* Gunther, 5 specimens from Peleliu and Palau Islands in the Western Pacific, from *Gallus gallus* and *Megapodius laperouse* respectively.

Of these specimens, which they compared with 5 paratypes of *yeomansi,* they found that one had 2 + 3 setae on coxae III, three had 3 + 3, and one 4 + 4.

In the present paper, two new species are recognized, which, while closely related to *yeomansi,* both differ in having the setae on coxae III normally 3 + 3, but variable from 2 to 4 on either side. From fourteen specimens of *yeomansi* known to me, there is no variation from the normal 2 + 2. The new species, *mcqueeni,* from Bougainville, however, shows 3 + 3 in 5 out of 6 specimens; the other specimen has 3 + 4. In 31 specimens of *owiensis* sp. n. from Owi Island, Dutch New Guinea, 15 have 3 + 3, fourteen have 3 + 4, and two have 2 + 3.

As there are, however, other differences between these three species, it would appear that the Peleliu and Palau specimens may be either *mcqueeni* or *owiensis* but almost certainly not *yeomansi* Gunther. Unfortunately, Wharton and Hardcastle do not give figures or details sufficiently to fix their material at present. The Standard Data given, suggests, however, its tentative association with *owiensis* sp. n.

NEOSCHÖNGASTIA OWIENSIS sp. n.

Plate 71, fig. F–H; 72, fig. A–B.

Description of Larvae. Length (unengorged) to 330μ, width to 210μ. Shape oval, slightly wider anterior of middle. Dorsal scutum as figured, with scutal setae tapering with long, outstanding branches; AM the shortest and well behind line of AL, AL the longest; sensillae distinctly setulose, more so than in *yeomansi;* anterior half of scutum pitted, posterior half over-lapped with circular striations. Eyes 2 + 2, on distinct ocular shields. Chelicerae with apical tricuspid cap, and on inner (dorsal) edge with a strong, forwardly directed subapical tooth. Galeal setae fine with only 2 or 3 fine branches. Palpi stout, femur and genu with strongly branched setae; dorsal and lateral setae of tibia nude, ventral branched; palpal tarsus with 4 or 5 ciliated setae, the longest slightly fasciculate, and the usual subapical and sub-basal sensory rods; claw short and stumpy, trifurcate. Dorsal setae with long outstanding

ciliations on anterior rows; anteriorly approximately 76, posteriorly approximately 46 stout, awl-like spines, distinctly ciliated rather than serrated as in *yeomansi*. Ventrally a pair of branched setae on maxillae, one fairly long on coxae I and II, and normally 3 + 3 (frequently 3 + 4, rarely 2 + 3) on coxae III; a pair of branched setae between coxae I and between coxae III, and thereafter approximately 50 tapering ciliated setae anterior of anus, and approximately 40 spines behind anus, similar to dorsal spines. Anterior dorsal setae to 45μ, posterior spines to 42μ.

Legs: I 390μ long, II 300μ, III 390μ; tarsi I and II with usual dorsal sensory rod; III without any long nude seta.

The Standard Data for 31 specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	79·7±0·39	2·16±0·28	73·2–86·2	75·6–84·0	2·7
PW	93·5±0·41	2·26±0·29	86·7–100·3	89·6–98·0	2·4
SB	62·15±0·31	1·70±0·22	57·05–67·25	58·8–64·4	2·7
ASB	28·3±0·15	0·83±0·10	25·8–30·8	28·0–30·8	2·9
PSB	27·45±0·20	1·11±0·14	24·15–30·75	25·2–28·0	4·0
SD	55·7±0·23	1·30±0·16	51·8–59·6	53·2–58·8	2·3
A–P	35·3±0·27	1·53±0·19	30·7–39·9	33·6–39·2	4·3
AM	34·8±0·39	2·13±0·27	28·4–41·2	28·0–39·2	6·1
AL	80·8±0·58	3·21±0·41	71·2–90·4	72·8–84·0	4·0
PL	51·6±0·55	3·04±0·39	42·5–60·7	47·6–56·0	6·0
Sens.	39·2 with head 20/28. No variation recorded				

Loc. Twenty-two specimens from boots, Owi Island, Dutch New Guinea, July and August 1944 (G. M. Kohls), and nine specimens from somewhere in the Western Pacific, (U.S. Navy, 3,505, A8).

Remarks. This species is close to *yeomansi* Gunther, but differs mainly in the setation of coxae III, the nature of the dorsal and scutal setae, and in the Standard Data. From *mcqueeni* sp. n., from Bougainville, it differs in the much larger dorsal scutum, and the very different Standard Data.

NEOSCHÖNGASTIA MCQUEENI sp. n.

Plate 72, fig. C–G.

Description of Larvae. Shape ovoid. Length (unengorged) to 270μ, width to 180μ. Scutum as figured, with AL the longest and AM the shortest and about in line with AL; all scutal setae with long outstanding branches; sensillae globose and distinctly with fairly long setules, their bases wide apart and in a crest about midway of the scutal depth. Eyes 2 + 2, on distinct ocular

plates. Chelicerae with apical tricuspid cap, and on inner (dorsal) edge a strong forwardly directed subapical tooth. Galeal setae fine with 2 or 3 fine branches. Palpi fairly stout; setae on femur and genu with fairly long branches; on tibia dorsal and lateral nude, ventral shortly branched; tarsi with the usual subapical and sub-basal sensory rods and 5 to 6 ciliated setae; tibial claw trifurcate but not short and stumpy as in *yeomansi* and *owiensis*. Dorsal setae, anteriorly approximately 60 in 6 rows of fine, tapering setae with long outstanding setules, posteriorly with about 28 stout awl-like spines with distinct short ciliations; anterior setae to 42μ long, spines to 28μ. Ventrally, with a pair of branched setae on maxillae, one on each of coxae I and II, three (rarely four) on each of coxae III, a pair between coxae I and between coxae III and thereafter ca. 42 fine ciliated setae followed behind the anus by ca. 36 spines similar to those on dorsum. The setae on coxae I and II are not as long as in *yeomansi* and *owiensis*.

Legs: I 340μ long, II 300, III 330μ; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for the type and 5 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	65·5±0·68	1·53±0·48	60·9–70·1	64·4–67·2	2·3
PW	74·5±1·68	3·76±1·19	63·2–85·8	70·0–78·4	5·0
SB	47·6	No variation recorded			
ASB	26·6±0·40	0·98±0·28	23·7–29·5	25·2–28·0	3·6
PSB	22·4	No variation recorded			
SD	49·0±0·40	0·98±0·28	46·1–51·9	47·6–50·4	2·0
A–P	32·7±0·59	1·44±0·42	28·4–37·0	30·8–33·6	4·4
AM	32·2±0·81	1·62±0·57	27·4–37·0	30·8–33·6	5·0
AL	57·4±0·81	1·62±0·57	52·6–62·2	56·0–58·8	2·8
PL	42·0	No variation recorded			
Sens.	28·0 with head 19/19. No variation recorded.				

Loc. The type and 5 paratypes in the collection of the South Australian Museum, from a small island to the North of Bougainville, August, 1946 (G. H. McQueen).

Remarks. This species is very closely related to both *owiensis* and *yeomansi* but differs from these in the much smaller dorsal scutum and Standard Data, and particularly in the tibial palpal claw not being stumpy. The scutal and dorsal setae are long branched as in *owiensis*. The dorsal setae are also somewhat fewer in number. Coxae III is trisetose as in *owiensis*, but only rarely 4-setose (not frequently as in *owiensis*); of the 6 specimens, only one showed 3 + 4 setae.

NEOSCHÖNGASTIA ATOLLENSIS Wharton and Hardcastle 1946.

J. Parasitol., 1946, 32, (3), 306, fig. (larva).

Plate 74, fig. H.

Described from *Numenius phaeopus* from Ulithi Atoll, August, 1945, and also from other birds from Okinawa, July, 1945.

This species is closely related to *namrui* Wharton and Hardcastle in having coxae III with more than 5 setae, the number varying from 5 to 7. In *namrui* the number varies from 7 to 12. The galeal setae are nude, whereas in *namrui* they are feathered.

The dorsal scutum is as figured, after Wharton and Hardcastle, PW much wider than AW. The sensillae are globose, with short pedicel and the sensillae heads lie in fairly well defined depressions surrounded by the circular cuticular striations. The AL setae are the longest. On the palpi the dorsal and lateral setae on the tibia are nude, the ventral and the femoral and genual are branched.

The dorsal setae are from 21 to 49μ long, with four humeral setae and then ca. 120 arranged in rows of 12 or less. Coxae I and II unisetose, posterior of coxae III about 100 setae ventrally. No long nude seta on coxae III.

The Standard Data as given by Wharton and Hardcastle for 6 specimens and treated statistically are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	46·5±0·95	2·34±0·68	39·5–53·5	42·0–48·0	5·0
PW	69·2±2·88	7·07±2·04	48·0–90·4	56·0–77·0	10·2
SB	20·5±1·58	3·88±1·12	8·9–32·1	14·0–24·0	19·0
ASB	19·5±1·06	2·58±0·75	11·8–27·2	15·0–22·0	13·2
PSB	31·2±1·30	3·19±0·92	21·7–40·7	27·0–35·0	10·2
SD	50·7±2·03	4·97±1·43	35·8–65·6	42·0–56·0	9·8
A–P	41·7±1·92	4·72±1·36	27·6–55·8	34·0–48·0	11·3
AM	26·2±1·14	2·79±0·80	17·9–34·5	21·0–28·0	10·6
AL	47·7±2·42	5·92±1·71	30·0–65·4	36·0–53·0	12·4
PL	33·0±1·05	2·68±0·77	25·0–41·0	28·0–35·0	8·1
Sens.	28·0±4·0	5·66±2·83	11·2–39·8	24·0–32·0	20·2

Remarks. The great variability shown above is largely due to the fact that the one specimen recorded from Okinawa had a very much smaller scutum than the Ulithi specimens.

NEOSCHÖNGASTIA NAMRUI Wharton and Hardcastle 1946.

J. Parasitol., 1946, 32, (3), 316, fig. (larva).

Plate 75, fig. G.

Described from Guam from *Numenius phaeopus* in May, 1945, and from *Heterosceles incanus* and *Pluvialis dominica* in September, 1945; and from *Gygis alba* on Okinawa in July, 1945.

This species is remarkable in that the scutum is slightly longer than wide, and with PW being shorter than AW, the lateral margins slightly converging posteriorly; the antero-lateral shoulders are somewhat strongly produced forwards. The lateral branches of AM are very long, those of PL not quite so long, but in both AM and PL much longer than in AL. Sensillae globose and setulose, with their bases nearer to AL than to PL. The galeal setae and all setae on palpal femur, genu and tibia are branched. The DS setae are very numerous, 44μ long anteriorly to 32μ posteriorly; there are about 15 setae on each shoulder and then about 175 setae behind these.

Coxae III with from 7 to 12 setae and posterior of coxae III with ca. 150 setae. Tarsus III without any long nude seta, but on the genua of all legs is a rather characteristic cluster of short nude setae.

The Standard Data for 7 specimens given by Wharton and Hardcastle and treated statistically are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	74·4±1·17	3·10±0·83	65·1–78·0	69·0–78·0	4·2
PW	60·2±2·06	5·46±1·46	43·9–76·5	53·0–69·0	9·1
SB	40·0±0·69	1·82±0·49	34·5–45·5	38·0–43·0	4·5
ASB	34·4±1·92	4·28±1·35	21·6–47·2	27·0–38·0	12·4
PSB	40·0±0·51	1·26±0·36	36·2–43·8	39·0–42·0	3·2
SD	74·4±2·2	4·93±1·56	59·7–89·1	66·0–78·0	6·6
A–P	46·2±0·51	1·34±0·36	42·2–50·2	45·0–48·0	3·0
AM	61·0±1·41	3·74±1·00	49·8–72·2	54·0–66·0	6·1
AL	70·4±0·57	1·51±0·40	65·7–74·9	69·0–73·0	2·1
PL	70·4±2·87	7·59±2·03	47·6–93·2	60·0–78·0	10·8
Sens.	36·7±2·15	5·70±1·52	19·6–53·8	24·0–44·0	1·6

Remarks. Close to *N. carveri* but easily distinguished by the characteristic scutum, sternal setae and the clusters of nude setae on the genua of the legs.

NEOSCHÖNGASTIA AMERICANA SOLOMONIS Wharton and Hardcastle 1946.

J. Parasitol., 1946, 32, (3), 289–292, fig.

Plate 74, fig. D.

Wharton and Hardcastle 1946 described a number of specimens from Bougainville, Iwo Jima and Okinawa as a variety of the American species, distinguished them mainly on the longer scutum.

For comparison they give the Standard Data of 5 specimens of *N. americana americana* from which the following statistics are now calculated:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	49·0±1·14	2·55±0·81	41·4–56·6	45·0–52·0	5·2
PW	66·8±1·65	3·70±1·17	55·7–77·9	62·0–72·0	5·5
SB	30·6±1·43	3·21±1·01	21·0–40·2	26·0–34·0	10·4
ASB	17·4±1·29	2·88±0·91	9·0–26·0	13·0–20·0	16·5
PSB	26·2±1·24	2·77±0·88	17·9–34·5	23·0–29·0	10·5
SD	43·8±1·65	3·70±1·17	32·7–54·9	38·0–48·0	8·4
A–P	27·6±0·75	1·69±0·53	22·6–32·6	26·0–31·0	6·1
AM	32·5±1·44	2·89±1·02	23·9–41·1	29·0–36·0	8·8
AL	54·75±3·66	7·32±2·58	32·8–76·7	49·0–65·0	13·3
PL	55·5±3·17	6·35±2·24	36·5–74·5	52·0–65·0	11·4
Sens.	25·3±1·46	2·55±1·03	17·7–32·9	23·0–27·0	10·0

The corresponding values for nine specimens from the Southern Pacific from Wharton and Hardcastle's data are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	51·7±1·38	4·16±0·98	39·2–64·2	45·0–57·0	8·0
PW	70·2±2·0	6·01±1·42	52·2–88·2	57·0–77·0	8·5
SB	34·0±1·43	4·30±1·01	21·1–46·9	28·0–39·0	12·7
ASB	25·7±0·81	2·14±0·57	19·3–32·1	24·0–28·0	8·3
PSB	29·4±0·53	1·39±0·37	25·2–33·6	28·0–31·0	4·7
SD	55·2±0·83	2·19±0·59	48·6–61·8	52·0–59·0	4·0
A–P	35·6±0·56	1·51±0·40	31·1–40·1	34·0–38·0	4·2
AM	43·6±1·49	4·47±1·05	30·2–57·0	36·0–50·0	10·2
AL	55·6±1·90	5·70±1·34	38·5–72·7	44·0–61·0	10·3
PL	57·1±2·29	6·88±1·62	36·5–77·7	42·0–66·0	12·0
Sens.	25·8±1·0	3·03±0·71	18·7–34·9	21·0–29·0	11·8

From these values the form from the Solomons only differs significantly in ASB, PSB, SD, A–P and AM, at the 1% level. In Hirst's figure (*loc. cit.*) there is shown a long nude seta very clearly on tarsus III, which is not mentioned or figured in Wharton and Hardcastle. It is, however, present in a specimen, given to me by Dr. Wharton, from Iwo Jima.

The DS are 32, arranged 2.8.6.4.6.2, and range in length from 68μ anteriorly to 28μ posteriorly. The setae on the palpi femur and genu are branched, and on the tibia the dorsal and lateral setae have one or two short branches, and the ventral is distinctly branched. Coxae III trisetose.

NEOSCHÖNGASTIA ENTOMYZA sp. n.

Paraschöngastea, sp., Gill, Moule and Reik, 1945, Aust. Vet. J., 32 (fig. 4).

Plate 72, fig. H–K; 73, fig. A.

Description of Larvae: Shape oval. Length, unfed, 405μ, width 255μ. Dorsal scutum as in fig. 66 and plate J with the usual 5 ciliated setae and a pair of finely setulose globose sensillae with their bases arising from a triple crest about midway between lines of AL and PL. Anterior margin sinuous with the shoulders anterior of the middle. Posteriorly the scutum with the usual crescentic striations. Eyes 2 + 2, very large and on prominent ocular shields, closely adjacent to the lateral margins of scutum, posterior eyes the smaller. Chelicerae with the usual apical tricuspid cap and on inner margin a subapical forwardly directed point. Galeal setae short, with a few short branches. Palpi stout, tibial claw rather slender and trifurcate, the median and longest prong surpassing apex of palpal tarsus; setae on femur and genu strongly branched; on tibia, dorsal apparently nude, lateral with one or two branches, and ventral with many branches; tarsus with the usual subapical and sub-basal sensory rods and 4 or 5 ciliated setae. Dorsal setae shortly ciliated, to 30μ long and 26 in number and arranged 2.8.6.4.4.2. Ventrally with the usual pair of branched setae on gnathosoma, one on coxae I and II, three on coxae III, a pair between coxae I and between coxae III and thereafter ca. 6.4.4.2.4.2, to 30μ long; the posterior dorsal and ventral setae are similar to the anterior and do not arise from platelets. Legs rather long and slender but I stronger and thicker than the others; tarsi I with a prominent subapical dorsal hump; tarsi I and II with the usual dorsal rod-like setae, III without any long nude seta, the corresponding setae being distinctly but shortly ciliated. Leg I 470μ long, II 415μ, III 496μ.

The Standard Data from one paratype and 13 other specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	47·1±0·51	2·10±0·41	40·8–53·4	44·8–50·4	4·4
PW	68·9±0·67	2·43±0·48	61·6–76·2	64·4–72·8	3·5
SB	30·6±0·59	2·13±0·42	24·2–37·0	28·0–33·6	7·0
ASB	20·8±0·38	1·44±0·27	16·5–25·1	19·6–22·4	6·9
PSB	29·4±0·39	1·45±0·27	25·1–33·9	28·0–30·8	4·9
SD	50·2±0·46	1·73±0·33	45·0–55·4	47·6–53·2	3·4
A–P	32·4±0·57	2·12±0·40	26·1–38·7	28·0–36·4	6·5
AM	31·85±0·74	2·08±0·52	25·6–38·1	30·8–36·4	6·5
AL	37·8±0·59	2·14±0·42	31·4–44·2	36·4–42·0	5·6
PL	45·8±0·70	2·53±0·50	38·2–53·4	42·0–50·4	5·5
Sens.	30·8 with head 22·4/25·2. No variation recorded.				

Loc. Said to be common on birds in the Clermont district, Queensland, along with *Trombicula* (*Leptotrombidium*) *myzantha* sp. n. by Messrs. Gill, Moule and Reik (Aust. Vet. J., April, 1945). The birds listed as carrying this species by these authors are *Struthidia cinerea* Gould 1837, *Entomyzon cyanotis* Latham 1801, *Cracticus torquatus* Latham 1801, *Myzantha melanocephala* Latham 1801, *Gymnorhina tibicen* Latham 1801, *Ocyphaps lophotes* Temminck 1822 and *Corvus cecilae* Mathews 1912.

Remarks. The description is drawn up from the type and 1 paratype in the collection of the McMaster Laboratory, Sydney, and 1 paratype in the South Australian Museum, all labelled from "leather head" (blue-faced honey-eater, *Entomyzon cyanotis*) from Wolfgang, Clermont, Queensland, coll. D. A. Gill, 18 Apr. 1944) and 1 specimen from a "lousy jack" (probably an Apostle bird, *Struthidia cinerea*) from Logan Downs, Queensland, 28th Nov. 1944 (coll. D. A. Gill) in the McMaster collection. The 13 other specimens from which the Standard Data are given were from *Entomyzon cyanotis* from Buckleton, C.Q. (5 spec.), Logan Downs, C.Q. and from *Pomatostomus temporalis*, Emerald, C.Q. (2 spec.), all in Nov. 1948 (H.W.).

I am greatly indebted to Mr. D. A. Gill for the opportunity of describing this species.

NEOSCHÖNGASTIA THOMASI (Radford 1946).

Paraschöngastia thomasi Radford 1946. Proc. Zool. Soc. London, 116, (2), (larva).

Plate 73, fig. B–D.

This species was briefly described by Radford from specimens from a Black-headed Shrike (*Lanius nasutus*) from Ukrul Road, Imphal, Manipur, 11 Feb., 1946.

In the shape of the scutum it appears to be very close to *entomyza* sp. n. only differing in that A–P is much longer and the scutum consequently deeper. The scutal setae are longer and the globular sensillae apparently nude. Posteriorly the scutum is overlapped by the dorsal cuticle with semicircular striations. The DS are slightly fewer than in *entomyza* and are arranged 2.6.6.4.4.2. No details of palpi and chelicerae are available. The eyes are 2 + 2, large, on ocular shields with the posterior eyes the smaller. The coxae are strongly punctate and III trisetose. Posterior of coxae III with 8.6.4.4.2.2 setae ventrally.

The Standard Data from Radford's figures are: AW 44·0, PW 63·0, SB 23·0, ASB 20·0, PSB 23·0, SD 43·0, A–P 34·0, AM 37·0, AL 51·0, PL 54·0, Sens. 29·0.

This species is so very close to *entomyza* that it may quite possibly, when more carefully studied from fresh material, be the same.

NEOSCHÖNGASTIA PAUENSIS Wharton and Hardcastle 1946.

J. Parasitol., 1946, 32, (3), 311, fig. (larva).

Plate 75, fig. B–D.

Described from *Pluvialis dominica* from Ulithi Atoll in August, 1945.

Close to *N. ewingi* but differing in that there are 3–4 setae dorsally on each shoulder instead of one. On the palpal femur, genu and tibia the setae are all branched except the dorsal and lateral tibial.

The dorsal scutum is as figured, after Wharton and Hardcastle, with the lateral margins strongly concave. PL the longest but only slightly longer than AL, and the sensillae bases slightly in front of half-way between lines of AL and PL. Galeal setae with 2 short branches.

Dorsal setae from 55μ anteriorly to 30μ posteriorly; as many as 5 humeral setae on each side, and then about 50 in rows of 10. Coxae III with 3–4 setae. Posterior of coxae III with about 60 setae. No long nude seta on tarsi III.

The Standard Data given by Wharton and Hardcastle for 5 specimens treated statistically are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	57·5±0·87	1·73±0·61	52·3–62·7	56·0–59·0	3·0
PW	77·0	No variation recorded			
SB	37·25±1·11	2·18±0·78	30·6–43·9	35·0–40·0	5·95
ASB	22·0	No variation recorded			
PSB	30·7±2·03	3·51±1·43	20·2–41·2	27·0–34·0	11·4
SD	52·5±3·50	4·95±2·47	45·3–59·9	49·0–56·0	9·4
A–P	31·25±0·75	1·50±0·53	26·75–35·75	29·0–32·0	4·8
AM	35·0±1·47	2·94±1·04	26·2–43·8	31·0–38·0	8·4
AL	52·5±3·5	4·95±2·47	37·7–67·3	49·0–56·0	9·2
PL	54·75±0·80	1·61±0·57	49·95–59·55	53·0–56·0	3·0
Sens.	29·3±0·89	1·53±0·62	24·8–33·8	28·0–31·0	5·2

NEOSCHÖNGASTIA SALMI (Oudemans 1922).

Schöngastia salmi, Ouds. 1922, Ent. Ber., 6, (126), 81 (brief diagnosis), *idem,* 6, (128), 114; Salm 1923, Bull. Soc. Pathol. Exot., 16, 236–300; Walch 1927, Geneesk. Tijds. Ned. Ind., 67, 931–932; Womersley and Heaslip 1944, Tr. Roy. Soc. S. Aust., 68, (1), 98; Sig Thor and Willmann, Das Tierreich, 71b, 304.

Plate 73, fig. E–G.

This species was originally briefly diagnosed by Oudemans in Ent. Ber., July, 1922, 6, (126), 81. Oudemans himself does not appear to have published any lengthy or full description, but such a description in German was drawn

up and is in the Oudemans' library and manuscripts in the possession of the Dutch Entomological Society under the care of Dr. G. L. van Eyndhoven. I am greatly indebted to Dr. Eyndhoven for a copy of this description.

Oudemans also made very careful and detailed drawings, and these (drawings No. 1126, 1127) are in the Oudemans' collection in the Leiden Museum, but have not been published. I am indebted to Miss A. M. Buitendijk for copies of these.

The species was only known from a single specimen collected by Dr. G. Salm from herbage at Magelang, Java.

In 1923, Salm (*loc. cit.*) gave a very full description in French, which is in reality a translation of Oudemans' manuscript so that it appears he must have received a copy of this from Oudemans himself. Only figures, very crude and inaccurate of an entire dorsal view and of the third leg are given, but not Oudemans' drawings.

In his description Salm states that the unique specimen is in his collection. He gives the date of Oudemans' original description as Apr. 15th, 1922, but no description appeared as far as I have been able to ascertain until July 1st, 1922.

The various characteristics of the animal and the different measurements given by Salm agree with Oudemans' manuscript description and the same measurements are also given by Walch 1927 (*loc. cit.*) when he briefly refers to the species.

The details as given by Oudemans' description and figures are: Length 450μ, width 267μ. Femora divided into basi- and telofemur. Length of leg I 225μ, II 200μ, III 235μ. Chelicerae non-serrate, with an inner subapical forwardly directed tooth. Palpi stout, tibial claw trifurcate; setae on femur and genu branched, on tibia dorsal and lateral nude but ventral branched. Eyes large, on ocular shields, posterior the smaller. Scutum as figured, with the sensillae globose and setulose and inserted in a strongly chitinized wall or crest; anteriorly pitted, posteriorly with semicircular striations; AL scutal setae the longest, AM the shortest. Dorsal setae ca. 2.12.12.10.10.10.10.10.10.10.10.10, = ca. 116, with a few on posterior border. Ventrally with paired branched setae on maxillae, one between coxae I and between coxae III, one on each of coxae I and II, and three on coxae III. Leg III without (?) a long nude seta on tarsi.

The Standard Data derived from Oudemans' figures are: AW 78·4, PW 100·8, SB 57·4, ASB 36·4, PSB 36·4, SD 72·8, A–P 43·4, AM 35·0, AL 71·4, PL 60·2, Sens. 35·0 with head 23·0/23·0.

NEOSCHÖNGASTIA DUBIA Gunther 1939.

Neoschöngastia incerta Gunther 1938 (*nom. nud.*), Med. J. Aust., 2, (6), 202.

Neoschöngastia dubia Gunther 1939, Proc. Linn. Soc. New South Wales, 64, (1–2), 89; Wharton and Hardcastle 1946, J. Parasitol., 32, (3), 294.

Paraschöngastia dubia Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 130.

Plate 74, fig. A–C.

This species is so far only known from the unique type from the New Guinea bush fowl, *Megapodius duperreyi* from Bulolo.

It is very close to, if not merely a race of, *ewingi* Wharton and Hardcastle, from which it only differs in a somewhat larger scutum with longer scutal setae, and rather more dorsal setae. Acording to Wharton and Hardcastle, *ewingi* does not possess a long nude seta on tarsi III, but a paratype in the South Australian Museum collection presented by Dr. Wharton, does possess such a seta, as given by Gunther for *dubia*. On page 310, Wharton and Hardcastle (*loc. cit.*) state that "three (nude setae on tarsi III) are reported for *dubia*". Reference to Gunther's original description, however, shows that he only mentions one such seta.

In their key to species of *Neoschöngastia* Wharton and Hardcastle separate *dubia* from *ewingi* by the lateral seta on its palpal tibia being nude instead of "with a few delicate barbs". In view of the lack of other more obvious differences, and the difficulty, even under oil immersion of detecting such fine barbs, it may be doubted whether this is a valid distinction.

If *ewingi* and *dubia* are different species, then the specific differences are in the number of dorsal setae, and the Standard Data. When more material of *dubia* becomes available it may be established that *ewingi* is synonymous.

Neoschöngastia dubia is also very close to *N. salmi* Ouds., of which I have been kindly given copies of Oudemans' original figures by Miss A. M. Buitendijk of the Leiden Museum, and also a copy of Oudemans' very detailed description in German from Oudemans' manuscript in the possession of the Entomological Society of Holland, and under the care of Dr. G. L. van Eyndhoven, to whom I am indebted for the copy. These drawings and description have not so far been published, but I understand that my colleague, Dr. Eyndhoven, will shortly do so.

From Oudemans' drawings and description, both *dubia* and *ewingi* are very close to *salmi*. Oduemans' species appears to differ from the others only

in having considerably more dorsal setae (ca. 126), in the larger scutum with scutal setae almost as long as in *dubia,* and apparently from both in having no long nude seta on tarsi III. With regard to this last feature, in view of the fact that it has been shown that Oudemans overlooked such a seta in *Schöngastia vandersandei,* it may possibly be that he overlooked it also in *salmi.*

The type of *salmi* from Java is said to be in the "Finders" collection, but its location has not yet been ascertained.

All three species have trisetose coxae III.

The Standard Data of the type of *dubia* (after Womersley and Heaslip 1943) are: AW 75·0, PW 98·0, SB 60·0, ASB 25·0, PSB 25·0, SD 50·0, A–P 38·0, AM 45·0, AL 80·0, PL 71·0, Sens. —.

NEOSCHÖNGASTIA EWINGI Wharton and Hardcastle 1946.

J. Parasitol., 1946, 32, 308, fig. (larva).

Plate 75, fig. F.

Described from *Egretta intermedia, Pluvialis dominica* and *Gallus gallus,* Ulithi Atoll, in August 1945; from *Gallus gallus* on Palau and Peleliu Islands in September, 1945; and from *Heteroscelus incanus* from Guam, Sept., 1945.

This species is very close to *N. dubia* Gunther from which it differs in not having a long nude seta (?) on tarsus III and the smaller scutum. Wharton and Hardcastle in comparing this species state "that there are no nude setae on tarsi III in *N. ewingi* while three are reported from *N. dubia*". Actually Gunther states that there "is only one very long slender nude seta on tarsi III", and a re-examination of the type of *dubia* Gunther confirms this.

The dorsal scutum is as figured (after Wharton and Hardcastle) with the sensillae broadly clavate and setulose and with AL very much the longest. All setae on the palpal femur and genu and tibia, except the dorsal tibial, are branched. The galeal setae have two short branches.

The DS are from 50 to 21μ long, with short barbs; they number 60 to 80 in poorly defined rows of 8 to 10, and roughly in two ill defined groups, an anterior of 40–50 and a posterior of about 30. Ventrally coxae III trisetose, and posterior of coxae III about 70 setae.

The Standard Data as given by Wharton and Hardcastle for 9 specimens treated statistically are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	62·7±1·26	3·77±0·89	51·4–74·0	57·0–69·0	6·0
PW	76·9±1·85	5·56±1·31	70·3–93·5	70·0–85·0	7·2
SB	50·9±1·26	3·79±0·89	39·5–62·3	45·0–55·0	7·4
ASB	22·0±0·80	2·40±0·56	14·8–29·2	18·0–25·0	10·9
PSB	29·2±0·52	1·56±0·37	24·5–33·9	27·0–32·0	5·4
SD	51·4±0·97	2·91±0·69	42·7–60·1	46·0–56·0	5·6
A–P	33·2±0·40	1·20±0·28	29·6–36·8	32·0–35·0	3·6
AM	31·0±1·0	2·64±0·77	23·1–38·9	28·0–35·0	8·5
AL	57·25±1·43	4·06±1·01	45·05–69·45	50·0–62·0	7·0
PL	40·9±0·65	1·96±0·46	35·0–46·8	38·0–43·0	4·8
Sens.	28·3±1·33	2·31±0·94	21·4–35·2	27·0–31·0	8·2

NEOSCHÖNGASTIA RIVERSI Wharton and Hardcastle 1946.

J. Parasitol., 1946, 32, (3), 299, fig. (larva).

Plate 74, fig. F.

This species was described from *Eurystomus orientalis, Haliaeetus sanfordi* and *Falco severus* from Bougainville, the first two hosts in July, and the last in October, 1944; and from *Halycon chloris* and *E. orientalis* from Samar, Philippine Islands, in March, 1945.

The species is remarkable in that there are 3 pairs of sternal setae instead of the usual 2 pairs, and the palpal claw is bifurcate. The galeal setae are small and nude. On the palpi all the setae on the femur, genu and tibia are branched. The dorsal scutum is small, with the anterior margin concave, and the posterior margin evenly rounded. The scutal and dorsal setae are finely barbed. The DS are 28 in number, from 29μ to 21μ long, and arranged 2.8.6.2.4.4.2. All coxae unisetose. Posteriorly of coxae III on the venter with 4.4.2.4.2 setae. On tarsi III there are 4 long nude setae.

The Standard Data from 10 specimens as given by Wharton and Hardcastle treated statistically are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	38·0±0·77	2·57±0·55	30·3–45·7	34·0–41·0	6·7
PW	57·4±0·66	2·20±0·47	50·8–64·0	52·0–60·0	3·8
SB	18·6±0·54	1·80±0·38	13·2–24·0	16·0–21·0	9·7
ASB	21·7±0·79	2·61±0·55	13·9–29·5	17·0–25·0	12·0
PSB	17·7±0·75	2·49±0·53	10·2–25·2	10·2–25·2	14·1
SD	39·5±1·07	3·56±0·76	28·8–50·2	31·0–44·0	9·0
A–P	24·6±0·65	2·16±0·46	18·1–31·1	21·0–28·0	8·8
AM	37·4±1·22	4·03±0·86	25·3–49·5	31·0–43·0	10·8
AL	53·5±1·42	4·72±1·01	39·4–67·6	43·0–60·0	8·1
PL	44·0±1·09	3·34±0·71	34·0–54·0	40·0–49·0	7·6
Sens.	27·0±0·82	2·72±0·58	18·9–35·1	23·0–31·0	10·1

NEOSCHÖNGASTIA CARVERI Wharton and Hardcastle 1946.

J. Parasitol., 1946, 32, (3), 313, fig. (larva) fig. (nymph).

Plate 75, fig. C.

Described from larvae from *Numenius phaeopus, Demigretta sacra, Pluvialis dominica* and *Arenaria interpres* from Guam, the first in June and September, 1945, the second and third in July, 1945 and the fourth in September, 1945; from Okinawa from *Gygis alba* and *Sterna dougallii* (*sic douglaii*) in July, 1945, and from *Monticola solitarius* in August, 1945; from *Pluvialis dominica* from Ulithi Atoll in August, 1945 and from *Heteroscelus incanus* from Peleliu Island in September, 1945.

From a larva from *D. sacra* from Guam the nymph was reared by Wharton and Hardcastle (see section on Adults and Nymphs).

The larvae of this species are distinguished from all others in that there are numerous setae, ca. 20–22, situated between the coxae and arranged in irregular rows. Coxae III is multisetose, with from 6–8 setae on each; I and II unisetose.

The dorsal scutum is characteristic in shape, as figured (after Wharton and Hardcastle) with PW being only very slightly greater than AW, and the lateral margins being straight and parallel except at the posterior corners; the anterior margin is strongly sinuous and the posterior margin straight except in the middle third where it is deeply incised. The PL scutal setae are very long and much longer than AM or AL. The sensillae are very broadly clavate and setulose with the bases nearer to AL than to PL.

The galeal setae are branched. The palpal setae of the femur, genu and tibia are all branched except the dorsal and lateral tibial.

The dorsal setae are long, from 98μ to 66μ and posterior of the humeral setae number ca. 100. On the venter the setae posterior of coxae III number about 100. Tarsus III without any long nude seta.

The Standard Data from 5 specimens given by Wharton and Hardcastle treated statistically are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	79·8±3·09	6·91±2·18	59·1–100·5	72·0–90·0	8·6
PW	83·8±2·75	6·14±1·94	65·4–102·2	78·0–93·0	7·3
SB	43·4±3·69	8·26±2·61	18·6–68·2	36·0–57·0	19·0
ASB	30·0±0·55	1·22±0·39	26·3–33·7	28·0–33·0	4·1
PSB	36·6±0·60	1·34±0·42	32·6–40·6	36·0–39·0	3·7
SD	66·6±1·00	2·30±0·73	59·7–73·5	64·0–69·0	3·4
A–P	45·2±1·35	3·03±0·96	36·1–54·3	42·0–48·0	6·7
AM	70·8±3·50	7·82±2·47	47·4–94·2	60·0–81·0	11·0
AL	73·8±2·94	6·57±2·08	54·1–93·5	66·0–84·0	9·0
PL	137·0±8·72	19·49±6·16	78·5–195·5	108·0–162·0	14·2
Sens.	40·2±2·24	5·02±1·58	25·2–55·2	36·0–48·0	12·5

KEY TO THE ASIATIC-PACIFIC SPECIES OF NEOSCHONGASTIA EWING 1929, S. STR. 1946.

1. Sternal setae of two pairs only. Palpal claw trifurcate 2
   More than two pairs of sternal setae 22

2. Coxae III with only 1 seta 3
   Coxae III with more than 1 seta 10

3. Galeal setae nude 4
   Galeal setae branched 8

4. With a distinct hemisphaerical elevation on the basal segment of the chelicerae. DS ca. 90, with only 1 humeral seta on each side, varying from 57μ long anteriorly to 33μ posteriorly. Setae on palpal femur and genu with branches; on tibia with ventral branched, dorsal and lateral nude.

   AW 58·75±10·5, PW 87·75±11·6, SB 29·25±6·7, ASB 29·75±3·8, PSB 26·0±10·1, SD 55·75±7·1, A–P 41·75±12·1, AM 60·75±9·9, AL 60·5±1·7, PL 60·25±1·5, Sens. 35·5±5·7.

   N. bougainvillensis Wharton and Hardcastle 1946.

   Without such a hemisphaerical elevation on basal segment of chelicerae 5

5. Dorsal setae more than 50, ca. 72 in number, with only 1 humeral, from 35μ long anteriorly to 17μ posteriorly. Seta on palpal femur branched; on genu nude; on tibia ventral branched, dorsal and lateral nude. No long nude seta on tarsi III.

   AW 40·0±5·2, PW 65·3±6·2, SB 13·0±6·0, ASB 33·7±3·4, PSB 14·3±3·4, SD 48·0±6·0, A–P 34·3±4·6, AM 24·3±·76, AL 36·7±6·2, PL 38·7±16·5, Sens. 21·5±2·1.

   N. strongi Wharton and Hardcastle 1946.

   Dorsal setae fewer than 50 in number 6

6. Head of sensillae spindle-like with long fine setules. DS 40 in number, arranged 2.8.6.6.6.6.4.2, from 62μ long anteriorly to 39μ posteriorly. Setae on palpal femur and genu branched; on tibia ventral branched, dorsal and lateral nude. A long nude seta on tarsi III.

   AW 55·8±8·0, PW 77·8±13·2, SB 32·4±5·5, ASB 24·6±4·0, PSB 26·4±8·4, SD 51·0±12·2, A–P 27·2±1·3, AM 42·6±18·6, AL 35·0±5·6, PL 75·2±18·8, Sens. 70·75±17·0.

   N. monticola Wharton and Hardcastle 1946.

   Head of sensillae globose 7

7. With a long nude seta on tarsi III. DS 34 in number, arranged 2.8.6.8.4.2.2.2, from 52μ long anteriorly to 43μ posteriorly. Setae on palpal femur and genu branched; on tibia ventral and lateral branched, dorsal nude.

   AW 75·2±9·8, PW 79·8±8·9, SB 47·4±9·1, ASB 25·4±6·9, PSB 33·6±7·8, SD 59·0±9·0, A–P 29·4±4·5, AM 49·0±7·6, AL 74·8±29·6, PL 52·4±10·5, Sens. 29·75±10·5.

   N. posekanyi Wharton and Hardcastle 1946.

Without any long nude seta on tarsi III. DS 44 in number, arranged 2.12.8.6.10.4.2. Setae on palpal femur and genu branched, on tibia ?. PL the longest.

AW 52·0, PW 60·0, SB 42·0, ASB 19·0, PSB 26·0, SD 45·0, A–P 30·0, AM 32·0, AL 35·0, PL 50·0, Sens. 26·0.

N. gallinarum Hatori 1920.

8. Posterior body setae arising from platelets. Striations and pitting weak on posterior sixth of dorsum. DS 72, arranged 2.14.14.10.8.8. 6.6.2.2, to 30–40μ long. Setae on palpal femur and genu branched; on tibia lateral and ventral branched, dorsal nude. No long nude seta on tarsi III.

AW 58·0, PW 72·0, SB 48·0, ASB 23·5, PSB 25·0, SD 48·5, A–P 42·0, AM 37·5, AL 47·0, PL 42·0, Sens. 30·0.

N. backhousei Gunther 1939.

Posterior dorsal setae similar to anterior and not on platelets .. 9

9. DS 68–76 in number, arranged roughly in rows of 10 except posteriorly, from 45μ long anteriorly to 21μ posteriorly. Setae on palpal femur and genu branched; on tibia ventral branched, lateral and dorsal nude. Punctation on scutum fine and scattered.

AW 65·3±8·7, PW 73·25±4·3, SB 53·0±7·3, ASB 21·75±5·7, PSB 30·5±11·1, SD 52·25±15·6, A–P 31·5±7·5, AM 27·7± 10·1, AL 57·3±6·4, PL 37·0±7·3, Sens. 31·0.

N. egretta Wharton and Hardcastle 1946.

DS 32, arranged 2.8.6.6.4.4.2, to 54μ long. AL almost twice as long as PL. Setae on palpal femur and genu branched; on tibia dorsal nude, lateral and ventral branched. Scutum with sparse but large punctations or tuberculations.

AW 75·5±6·8, PW 85·0±5·7, SB 43·0±4·6, ASB 22·5±4·9, PSB 30·3±2·5, SD 52·8±6·4, A–P 33·0, AM 57·6±4·0, AL 85·8±6·1, PL 51·75±8·6, Sens. 32·0. *N. struthidia* sp.n.

10. Some posterior dorsal and ventral setae specialized and spine-like, and arising from platelets 11

Posterior dorsal and ventral setae similar to anterior 14

11. Coxae III bisetose 12

Coxae III tri-, rarely quadri-setose 13

12. Posteriorly, both dorsally and ventrally with a ring of strong long spines arising from small platelets, and inside the ring a number of more or less rectangular plates each with a short nude seta. Palpal claw long and over-reaching tip of tarsus by tarsus length. DS 52, arranged 2.8(10), 12(10), 6.8(10), 8.8(6). Setae on palpal femur and genu branched; on tibia dorsal nude, lateral and ventral branched.

AW 71·4±6·0, PW 84·5±11·5, SB 55·5±6·0, ASB 28·0, PSB 21·3±6·0, SD 44·4±4·1, A–P 35·25±2·1, AM 36·0, AL 72·0± 8·5, PL 51·4±11·8, Sens. 36·0. *N. retrocincta* Gunther 1939.

Posteriorly no such circle of spines. Palpal claw shorter and stouter, only slightly exceeding tip of tarsus. DS ca. 100, arranged 2, plus six rows of 8 to 16, then 10(8), 6.4.4. Setae on palpal femur and genu branched; on tibia dorsal and lateral short and nude, ventral branched.

AW 77·15±4·4, PW 103·1±16·7, SB 64·1±5·0, ASB 30·5± 2·8, PSB 28·3±2·8, SD 58·8±4·2, A–P 36·4±5·9, AM 39·2± 9·7, AL 83·1±7·4, PL 55·6±3·2, Sens. 39·2.

N. yeomansi Gunther 1939.

13. DS ca. 120 including ca. 46 spines posteriorly. Scutum larger. Coxae III normally 3-setose, but frequently 4-setose.

AW 79·7±6·5, PW 93·6±6·8, SB 62·15±5·1, ASB 28·3±2·5, PSB 27·45±3·3, SD 55·7±3·9, A–P 35·3±4·6, AM 34·8±6·4, AL 80·8±9·6, PL 51·6±9·1, Sens. 39·2. *N. owiensis* sp. n.

DS ca. 88 including ca. 28 spines posteriorly. Scutum smaller. Coxae III 3-setose (very rarely 4-setose).

AW 65·6±4·6, PW 74·5±11·3, SB 47·6, ASB 26·6±3·0, PSB 22·4, SD 49·0±3·0, A–P 32·7±4·3, AM 32·2±4·9, AL 57·4± 4·9, PL 42·0, Sens. 28·0. *N. mcqueeni* sp. n.

14. With more than 5 setae on coxae III 15

With fewer than 5 setae on coxae III 16

15. Galeal setae nude. PW greater than AW. Coxae III with 7 setae. DS ca. 120 in number in rows of 10 or fewer, and with about 4 humeral setae on each side, 49μ long anteriorly to 21μ posteriorly. Setae on palpal femur and genu branched; on tibia, dorsal and lateral nude, ventral branched.

AW 46·5±7·0, PW 69·2±21·2, SB 20·5±11·6, ASB 19·5±7·7, PSB 31·2±9·6, SD 50·7±14·9, A–P 41·7±14·1, AM 26·2±8·4, AL 47·7±17·7, PL 33·0±8·0, Sens. 28·0±16·9.

N. atollensis Wharton and Hardcastle 1946.

Galeal setae branched. PW less than AW. Coxae III with 10 setae. DS ca. 205, with about 15 humeral setae on each side, and then ca. 175, to 44μ long anteriorly, 32μ posteriorly. Setae on palpal femur, genu and tibia all branched.

AW 74·4±9·3, PW 60·2±16·5, SB 40·0±5·4, ASB 34·4±12·8, PSB 40·0±3·8, SD 74·4±14·8, A–P 46·2±4·0, AM 61·0±11·2, AL 70·4±4·5, PL 70·4±22·8, Sens. 36·7±17·1.

N. namrui Wharton and Hardcastle 1946.

16. Body setae fewer than 50 17
Body setae more than 50 19

17. DS 32 in number, arranged 2.8.6.4.6.4.2, from 68μ anteriorly to 28μ posteriorly. All setae on palpal femur, genu and tibia branched. A long nude seta on tarsi III.

AW 51·7±12·5, PW 70·2±18·0, SB 34·0±12·9, ASB 25·7±6·4, PSB 29·4±4·2, SD 55·2±6·6, A–P 35·6±4·5, AM 43·6±13·4, AL 55·6±17·1, PL 57·1±20·6, Sens. 25·8±9·1.

N. americana solomonis Wharton and Hardcastle 1946.

DS fewer than 30 18

18. DS 26 in number, arranged 2.8.6.4.4.2, to 30μ long. PL the longest. Setae on palpal femur and genu branched; on tibia, ventral strongly branched, lateral with 2 branches, dorsal nude. No long nude seta on tarsi III.

AW 47·1±6·3, PW 68·9±7·3, SB 30·6±6·4, ASB 20·8±4·3, PSB 29·4±4·3, SD 50·2±5·2, A–P 32·4±6·4, AM 31·85±6·2, AL 37·8±6·4, PL 45·8±7·6, Sens. 30·8. *N. entomyza* sp. n.

DS 24 in number, arranged 2.6.6.4.4.2, to 50μ long. PL and AL subequal, AM the shortest. Sensillae apparently nude.

AW 44·0, PW 63·0, SB 23·0, ASB 20·0, PSB 23·0, SD 43·0, A–P 34·0, AM 37·0, AL 51·0, PL 54·0, Sens. 29·0, (after Radford).

N. thomasi (Radford 1946).

19. With as many as 3 humeral setae on each side. Coxae III 3–4 setose. DS ca. 56 in indistinct rows of 10, anteriorly 55μ long, posteriorly 30μ. Galeal setae barbed. Setae on palpal femur and genu branched; on tibia dorsal and lateral nude, ventral branched. No long nude seta on tarsi III.

AW 57·5±5·2, PW 77·0, SB 37·25±6·5, ASB 22·0, PSB 30·7±10·5, SD 52·5±14·9, A–P 31·25±4·5, AM 35·0±8·8, AL 52·5±14·9, PL 54·75±4·8, Sens. 29·3±4·6.

N. pauensis Wharton and Hardcastle 1946.

With only 1 humeral seta on each side. Coxae III 3-setose 20

20. Apparently without a long nude seta on tarsi III. DS ca. 116–120, arranged ca. 2.12.12.10.10.10.10.10.10.10.10.+.

AW 78·4, PW 100·8, SB 57·4, ASB 36·4, PSB 36·4, SD 72·8, A–P 43·4, AM 35·0, AL 71·4, PL 60·2, Sens. 35·0 (after Oudemans). *N. salmi* (Oudemans 1922).

With a long nude seta on tarsi III 21

21. DS 90–96 in number, arranged ca. 2.14.10.12.6.14.14.12.8.4, to 30μ long. AL the longest but only slightly longer than PL. Setae on palpal femur and genu branched; on tibia dorsal and lateral nude; ventral l-branched.

AW 75·0, PW 98·0, SB 60·0, ASB 25·0, PSB 25·0, SD 50·0, A–P 38·0, AM 45·0, AL 80·0, PL 71·0, Sens. —.

N. dubia Gunther 1939.

DS 60–80 in number, in two ill-defined areas, anteriorly to 50μ long, posteriorly to 21μ. Setae on palpal femur and genu branched; on tibia dorsal nude, lateral with a few delicate barbules, ventral branched.

AW 62·7±11·3, PW 78·9±16·7, SB 50·9±11·4, ASB 22·0±7·2, PSB 29·2±4·7, SD 51·4±8·7, A–P 33·2±3·6, AM 31·0±7·9, AL 57·25±12·2, PL 40·9±5·9, Sens. 28·3±6·9.

N. ewingi Wharton and Hardcastle 1946.

22. With three pairs of sternal setae. Palpal claw bifurcate. All coxae 1-setose. DS 28 in number, arranged 2.8.6.2.4.4.2, from 29μ to 21μ long. All setae on palpal femur, genu and tibia branched. Galeal setae nude.

AW 38·0±7·7, PW 57·4±6·6, SB 18·6±5·4, ASB 21·7±7·8, PSB 17·7±7·5, SD 39·5±10·7, A–P 24·6±6·5, AM 37·4±12·1, AL 53·5±14·1, PL 44·0±10·0, Sens. 27·0±8·1.

N. riversi Wharton and Hardcastle 1946.

With numerous unpaired sternal setae. Palpal claw trifurcate. Coxae III 6-setose. DS ca. 120, with 8–10 humeral on each side, from 93μ long anteriorly to 66μ posteriorly. Setae on palpal femur and genu branched; on tibia dorsal and lateral nude, ventral branched. Galeal setae branched.

AW 79·2±20·7, PW 83·8±18·4, SB 43·4±24·8, ASB 30·0± 3·7, PSB 36·6±4·0, SD 66·6±6·9, A–P 45·2±9·1, AM 70·8± 23·4, AL 73·8±19·7, PL 137·0±58·5, Sens. 40·2±15·0 (from Wharton and Hardcastle's data).

N. carveri Wharton and Hardcastle 1946.

Genus MACKIENA Traub and Evans 1950.

J. Washington Acad. Sci., 1950, 40, (4), 126.

This remarkable genus is characterized chiefly by the empodium of all legs, instead of being claw-like, being expanded to form something like a pad or sucker such as occurs in many other groups of Acarids, but hitherto unknown in the Trombidiid families. The authors relate the genus to *Riedlinia* Ouds. 1914, but in that genus the empodium although swollen is not the same as in *Mackiena* and may still be regarded as claw-like.

The sensillae are globose, with only indications of a crest at their bases. The caudal portion of the scutum with distinct concentric striations as in *Neoschöngastia*.

Genotype *Mackiena empodiformis* Traub and Evans 1950.

MACKIENA EMPODIFORMIS Traub and Evans 1950.

J. Washington Acad. Sci., 1950, 40, (4), 126–129, fig. 1–4.

Plate 68, fig. E–I.

Description of Larvae (after Traub and Evans). Shape ovate-subcircular. Length 230μ, width 185μ. Scutum (as figured), anterior margin slightly sinuate with one median and two lateral lobes, lateral margins evenly convex, posterior margin fairly deep behind line of PL and flat medially; surface finely punctate annually, with concentric striations posteriorly; sensillae in line of PL, globose and setulose, with a slight indistinct crest in front of bases; AL very much longer than AM or PL. Eyes 2 + 2, well developed, posterior the smaller. Chelicerae non-serrate but with well pronounced apical tricuspid cap and dorsal subapical tooth. Galeal setae ?. Palpi stout, tibial claw trifurcate; seta on femur well branched, on genu with 2 short branches, on tibia dorsal and lateral nude and ventral with one branch. Dorsal setae strong and shortly ciliated or barbed, arranged 2.6.4.6.6.4.2 = 30, to 60μ. Ventrally, a pair of ciliated setae on maxillae, one on each coxae, a pair between coxae I and 2 pairs between coxae III, thereafter ca. 36 setae, arranged 10.8.8.+. Legs: I 260μ, II 250μ, III 270μ; tarsi I and II with dorsal sensory rod (spur), III without any long nude seta.

The Standard Data for the type and paratype as given by the authors are:

	AW	PW	SB	ASB	PSB	SD	A–P	AM	AL	PL	Sens.
Type	56·0	76·0	37·0	21·0	21·0	42·0	19·0	46·0	84·0	66.0	3.0
Para-type	57·0	78·0	38·0	—	—	—	—	42·0	84·0	67·0	—

Loc. and Host. This species was described from only two specimens from a weaver-finch (*Ploceus manyar peguensis* Stuart Baker) from 20 miles north-west of Myitkyina, Burma, on Mogaung Rd., Feb. 23/1945 (U.S. Typhus Com.).

Remarks. The host being a bird supports the close association of this genus and species with the genus *Neoschöngastia* Ewing, as suggested by the concentric scutal striations.

Subfamily GAHRLIEPIINAE nom. nov.

= *Walchiinae* Ewing 1946, J. Parasitology, 32, (5), 435.

Trombiculidae in which the dorsal scutum of the larvae is without the AM seta, and in which tarsi I of the nymphs and adults have a short dorso-apical stump-like process.

Containing only the single genus *Gahrliepia* Oudemans 1912.

Genus GAHRLIEPIA Ouds. 1912.

= *Typhlothrombium* Oudemans 1910, Ent. Ber. Ned. Ent. Ver., 3, 102.

Gahrliepia Oudemans 1912, Ent. Ber., Ned. Ent. Ver., 6, 237; Sig Thor and Willmann, Das Tierreich 1947, 71b, 332.

Schöngastiella Hirst 1915, Bull. Ent. Res., 6, 183; Sig Thor and Willmann 1947, Das Tierreich, 71b, 334.

Walchia Ewing 1931, Proc. U.S. Nat. Mus., 80, (8), 10; Sig Thor and Willmann 1947, Das Tierreich, 71b, 335.

Gateria Ewing 1938, J. Wash. Acad. Sci., 28, (6), 295; Sig Thor and Willmann, 1947, Das Tierreich, 71b, 338.

The genus *Typhlothrombium* was founded on the single species *T. nanus* Ouds. 1912 from S. Africa. In 1912 Oudemans proposed *Gahrliepia* in its place, as *Typhlothrombium* had been used earlier for an adult genus of Trombidiid mites. In *Gahrliepia* as represented by the genotype the dorsal scutum in addition to the AL and PL setae, carries two pairs of additional setae. In 1915, Hirst erected the genus *Schöngastiella* for *S. bengalensis* in which the scutum was furnished with only one pair of setae in addition to the AL and PL setae. Ewing proposed the genus *Walchia* in 1931 with *Trombicula glabrum* Walch from the Dutch East Indies as the genotype for those species in which the scutum was somewhat pentagonal but did not carry any setae other than AL and PL.

The genus *Gateria* was proposed by Ewing in 1938 with *Gahrliepia fletcheri* Gater as type, for those species of *Gahrliepia* in which most of the additional scutal setae are not marginal.

In 1943, Womersley and Heaslip showed that the number of additional scutal setae in the genera *Gahrliepia, Schöngastiella* and *Gateria* were really correlated with the prolongation in a posterior direction of the scutum, which thereby embraced some of the median setae of some of the dorsal rows. These three genera were therefore regarded as synonymous.

Ewing (1938) in his key to the larval genera of the Trombiculidae gives for *Schöngastiella* Hirst "eyes present;" for *Walchia* Ewing "eyes absent" and for *Gahrliepia* "eyes usually present." It is frequently very difficult in microscopic mounts of these mites to be reasonably certain as to whether eyes are truly present or not, but in the species recognized by Womersley and Heaslip 1943 as falling into *Gahrliepia* (in the wide sense, i.e. including *Schöngastiella* and *Gateria*) eyes are absent in *nanus* Ouds.; in *Walchia* eyes are present in *disparunguis* and *morobensis* and absent in all other species. Of the following species described by Radford 1946, *Gateria hirsuta, crocidura,*

Schöngastiella brevis, lancearia, ligula and *punctata*, eyes apparently are absent except in the last where they are relatively small.

It seems, therefore, that the presence or absence of eyes is of no more generic importance than the number of additional setae on the scutum, and that all four genera should be considered synonymous, with priority to *Gahrliepia* Ouds., or at most, of not greater than subgeneric status.

Further support for this is given in the section of this paper dealing with the adults and nymphs, where it is shown that all four genera in the known reared nymphs have a characteristic short dorso-apical process on tarsi I but otherwise only differ in specific characters, such as the dorsal setae.

In the following key to the known larval species from the Asiatic-Pacific Region, the various genera which have been proposed are only given subgeneric rank for convenience.

Key to the Species.

1. Scutum small, pentagonal, wih posterior margins forming a more or less acute angle. Only AL and PL setae on scutum 2
   Subgen. *Walchia* Ewing.

   Scutum usually larger, not pentagonal, frequently produced tongue-like beyond PL and taking in two or more setae from the dorsal rows 8

2. Coxae III unisetose 3
   Coxae III multisetose 5

3. Scutum small, AW smaller than 32·0μ. AL, Sens. bases, and PL in approx. the same longitudinal line. Sides of scutum between AL and PL convex. Sensillae clavate, apex aciculate, strongly setulose.
   AW 29·5±6·7, PW 32·9±4·1, SB 28·1±4·5, ASB 19·2±5·9, PSB 44·0+4·1, SD 63·2±4·5, A–P 35·4±3·2, AL 27·4±7·3, PL 29·5±5·3, Sens. 25·6 with head 9·6/19·2.
   Gahrliepia (*Walchia*) *morobensis* Gunther 1939.

   Scutum larger, AW greater than 32·0μ. AL, Sens. bases, and PL not in the same longitudinal line 4

4. Scutum with PSB not greater than PW; posterior scutal angle shallow. Dorso-apical tooth of chelicerae backwardly directed.
   AW 36·6±3·1, PW 44·5±2·6, SB 29·7±2·4, ASB 19·7±4·5, PSB 44·1±4·2, SD 63·75±3·6, A–P 35·7±3·95, AL 30·0, PL 30·0, Sens. —.
   Gahrliepia (*Walchia*) *rustica* Gater 1932.

   Scutum with PSB greater than PW, posterior scutal angle deeper .. 4a

4a. Only 1 humeral seta on each side. Dorsal-apical tooth of cheliceral tricuspid cap blunt and not directed backwards. Coxae III 1-setose. No setae between coxae II and III.

AW 38·35±4·15, PW 48·6±6·3, SB 32·4±4·4, ASB 22·5±1·5, PSB 56·7±7·3, SD 79·4±7·8, A–P 40·65±4·45, AL 32·9±4·9, PL 32·6±4·4, Sens. 32·0 with head 9·6/22·4.

Gahrliepia (*Walchia*) *turmalis* Gater 1932.

With 2–3 humeral setae on each side. Ventrally between coxae II and III 3–4 setae.

(Standard Data as in *Gahrliepia* (*Walchia*) *brennani* sp n.).

Gahrliepia (*Walchia*) *brennani* var. *ventralis* nov.

5. Scutum very small, with AW smaller than 20μ. Coxae III 6-setose. Dorsal setae 2.6.6.6.6.2.2. Palpal claw trifurcate.

AW 19·5±2·1, PW 31·65±2·75, SB 17·25±3·0, ASB 19·3±2·5, PSB 28·0, SD 47·3±2·5, A–P 30·4±3·0, AL 14·0, PL 14·0, Sens. 19·6 with head 11/14.

Gahrliepia (*Walchia*) *lewthwaitei* Gater 1932.

Scutum larger, AW greater than 20μ. Coxae III not 6-setose .. 6

6. Coxae III 2 setose. With only 1 humeral seta on each side .. 6a

6a. Coxae III more than 2-setose 7

AW 27·45±4·8, PW 44·6±4·85, SB 23·3±3·8, ASB 20·3±3·8, PSB 36·1±4·55, SD 56·4±4·6, A–P 32·8±4·3, AL 22·4, PL 28·8, Sens. 25·6 with head 9·6/19·2.

Gahrliepia (*Walchia*) *disparunguis* (Ouds. 1929).

With 2–3 humeral setae on each side. Scutum larger. Dorsal setae 32–34 in number, to 30μ long and arranged 6(4).6.6.6.6.2.2.

AW 37·5±12·0, PW 54·1±14·4, SB 32·8±16·8, ASB 21·8, PSB 57·8±12·9, SD 79·6±12·9, A–P 37·6±12·0, AL 27·3±10·8, PL 26·8, Sens. 33·5 with head 10·05/23·45.

Gahrliepia (*Walchia*) *brennani* sp. n.

7. Coxae III normally 3-setose, very rarely with 3 + 4. Palpal claw bifurcate. Dorsal setae 2.6.6.6.6.4.2.

AW 28·4±3·2, PW 48·8±8·8, SB 25·0±3·6, ASB 22·4, PSB 34·3±4·3, SD 56·7±4·3, A–P 36·7±8·1, AL 22·4, PL 28·8, Sens. 28·8 with head 11·2/22·4.

Gahrliepia (*Walchia*) *Gahrliepia* (*Walchia*) *ewingi* Fuller 1949. = *glabra* (Walch 1927, emend. Fuller 1948).

Coxae III normally 4-setose, but very variable from 4 + 3 to 5 + 6. Palpal claw apparently trifurcate. Dorsal setae 2.8.6.6.4.4.2.

AW 26·5±4·4, PW 37·6±6·4, SB 21·0±4·4, ASB 18·9±2·3, PSB 32·75±5·95, SD 52·0±6·0, A–P 30·95±4·1, AL 19·2±2·3, PL 20·7±4·1, Sens. 22·4 with head 12·8/16·0.

Gahrliepia (*Walchia*) *enode* (Gater 1932).

8. Dorsal scutum produced, tongue-like, behind PL, but with only the AL and PL setae; much longer than wide with the posterior end lightly concave. Eyes absent. Coxae III 2-setose. SB very much nearer to PL than to AL.

AW 30·0, PW 50·0, SB 25·0, ASB 18·0, PSB 58·0, SD 76·0, A–P 24·0, AL 28·0, PL 40·0, Sens. —. (After Gunther 1940; Womersley and Heaslip 1943).

Gahrliepia (? *Walchia*) *rioi* Gunther 1940.

Dorsal scutum produced, and besides AL and PL with additional setae belonging to the dorsal rows 9

9. Dorsal scutum with only 2 setae, in addition to AL and PL, and these from the second dorsal row 10

Subgen. *Schöngastiella* Hirst 1915.

Scutum with 4 additonal setae besides AL and PL 15

Subgen. *Gahrliepia* Ouds. 1912 s. str.

Dorsal scutum with more than 4 additional setae, and these from the second, third or more dorsal rows 20

Subgen. *Gateria* Ewing 1938.

10. Dorsal scutum very sharply contracted posterior of PL, ligulate. Sensillae more or less globose and setulose 11

Dorsal scutum otherwise 12

11. Distance A–P of scutum at least equal to or greater than distance between PL and the posterior pair of scutal setae. Coxae III 1-setose. Dorsal setae ca. 2.8[2].8.4.8.6.6.2.2.

AW 36·8±5·6, PW 51·9±6·9, SB 35·6±4·7, ASB 26·5±4·1, PSB 65·5±9·6, SD 92·0±11·1, A–P 44·7±5·15, AL 42·0±3·2, PL 42·0, Sens. 33·6 with head 14·0/25·2.

Gahrliepia (*Schöngastiella*) *ligula* (Radford 1946).

Distance A–P of scutum much less than distance from PL to posterior pair of setae. Coxae III 4-setose (sometimes 5–6 setose). Dorsal setae 2.6[2].8.8.6.4.4(2).2(0).

AW 31·0, PW 28·0, SB 23·0, ASB 14·0, PSB 55·0, SD 69·0, A–P 28·0, AL 20·0, PL 20·0, Sens. 20·0 wih head 14·0/14·0.

Gahrliepia (*Schöngastiella*) *ceylonica* sp. n.

12. Scutum about as long as broad; distance from line of PL to apex less than distance between PL. Sens. ? Dorsal setae 2.6[2].6.8.4.2. Coxae III 2-setose.

AW 44·0, PW 86·0, SB 51·0, ASB 26·0, PSB 78·0, SD 104·0, A–P 43·0, AL 38·0, PL 41·0, Sens. —. (After Radford).

Gahrliepia (*Schöngastiella*) *brevis* (Radford 1946).

Scutum much deeper from line of PL to apex than distance between PL. Sens. clavate. Coxae III 1- or multisetose 13

13. Margin of scutum posterior of PL more or less an even parabolic curve. Coxae III 1-setose. Dorsal setae 2.6[2].8.8.6.4.2.2.

AW 36·7±4·7, PW 50·6±6·5, SB 31·7±8·0, ASB 21·1±8·1, PSB 58·1±15·1, SD 79·2±9·2, A–P 37·6±5·0, AL 31·45±9·7, PL 35·8±1·3, Sens. 33·0 with head 15/21.

Gahrliepia (*Schöngastiella*) *bengalensis* (Hirst 1915)

Margin of scutum posterior of PL more or less triangular. Coxae III 2- or 4-setose 14

14. Coxae III 2-setose. Dorsal setae 2.4[2].6.6.6.4.2.2. Galeal and seta on palpal femur branched.

AW 45·2±7·1, PW 68·5±13·2, SB 43·5±7·6, ASB 22·7±2·8, PSB 91·5±29·3, SD 114·1±28·8, A–P 44·9±6·6, AL 38·4, PL 38·4, Sens. 35·2 with head 9·6/22·4.

Gahrliepia (*Schöngastiella*) *punctata* (Radford 1946).

Coxae III 4-setose. Dorsal setae 2.6[2].6.6.6.4.2. Galeal and seta on palpal femur nude.

AW 51·2, PW 76·8, SB 49·6, ASB 28·0, PSB 110·0, SD 138·0, A–P 51·2, AL —, PL 41·6, Sens. —.

Gahrliepia (*Schöngastiella*) *kumaonensis* sp.n.

15. Scutum markedly ornate, with 4 additional setae 16

Scutum at most only minutely punctate 18

16. PL behind line of SB. Scutum with large, nearly contiguous square to hexagonal reticulations. DS 32 in number, arranged 2.6[2].6[2].6.6.4.2.

AW 44·6, PW 75·6, SB 44·6, ASB 22·4, PSB 173·6, SD 196·0, A–P 30·8, AL 39·2, PL 53·2, Sens. —.

Gahrliepia (*Gahrliepia*) *insigne* sp. n.

PL in front of line of SB 17

17. Scutum uniformly with widely separated, more or less circular depressions. DS 34 in number, arranged 2.6.6[2].6[2].4.4.2.2.2.

AW 41·6±3·2, PW 66·8±5·8, SB 30·8, ASB 22·4, PSB 239·6±31·7, SD 262·0±31·7, A–P 17·2±5·8, AL 26·8±4·5, PL 108·8±12·3, Sens. —.

Gahrliepia (*Gahrliepia*) *decora* sp. n.

Scutum medially with a longitudinal cluster of raised tubercles, and laterally around the margin, large squarish depressions. DS 2.4[2].8[2].8.8.6.4.2.

AW 40·0, PW 59·0, SB 33·6, ASB 25·2, PSB 218·4, SD 243·6, A–P 12·0, AL 28·0, PL 98·0, Sens. —.

Gahrliepia (*Gahrliepia*) *ornata* sp. n.

18. Scutum with only 8 (occasionally 6–9) setae, excluding the sensillae 19

Scutum with more than 8 setae, excluding the sensillae 20

19. Coxae III unisetose. Scutum larger. Dorsal setae 2.6[2].6[2].6.6.4.4.2.

AW 42·0, PW 90·0, SB 49·0, ASB 35·0, PSB 155·0, SD 190·0, A–P 65·0, AL 40·0, PL 55·0, Sens. 37·0 with head 12/30 (after Gater; and Womersley and Heaslip).

Gahrliepia (*Gahrliepia*) *cetrata* (Gater 1932).

Coxae III 4-setose. Scutum smaller. Dorsal setae 2.8[2].9.[2–5].8.6.4.4.2.

AW 48·9±4·7, PW 63·5±6·6, SB 41·4±1·8, ASB 22·4, PSB 65·4±5·1, SD 87·8±5·1, A–P 38·4, AL 35·65±4·4, PL 35·2, Sens. 38·4 with head 12·8/25·6.

Gahrliepia (*Gahrliepia*) *saduski* sp. n.

20. PL normally situated, posterior of SB and far distant from AL 21

PL placed anterior of SB and closely adjacent to AL, longer than other scutal setae. Coxae III 1-setose. Additional scutal setae variable in number, normally 8 (occasionally 7–10). Dorsal setae normally 2.4[4].4[2].8[2].6.4.4.2.2.

AW 38·4, PW 56·0, SB 43·2, ASB 22·4, PSB 107·2, SD 129·6, A–P 9·6, AL 41·6, PL 64·0, Sens. 33·0 with head 9·0/23·0.
Gahrliepia (*Gateria*) *hirsuta* (Radford 1946).

21. Sensillae lanceolate. Coxae III 1-setose. DS 2.8[4].8[2].8.8.6.4. Scutum and coxae apparently not punctate.

AW 51·0, PW 85·0, SB 51·0, ASB 27·0, PSB 119·0, SD 146·0, A–P 35·0, AL 44·0, PL 68·0, Sens. 48·0 (after Radford).
Gahrliepia (*Gateria*) *lancearia* (Radford 1946).

Sensillae clavate 22

22. Only 6 additional setae on scutum 23

With 8 or more additional setae on scutum 24

23. Dorsal scutum widest, only just behind line of PL. DS 46 in number, arranged 2.8[4].8[2].8.8.6.4.2.

AW 51·0, PW 85·0, SB 51·0, ASB 27·0, PSB 119·0, SD 146·0, A–P 36·0, AL 44·0, PL 57·0, Sens. ?
Gahrliepia (*Gateria*) *crocidura* (Radford 1946).

Dorsal scutum widest well behind line of PL. DS 40 in number, arranged 2.8[4].6[2].6.6.4.2.2.

AW 50·0, PW 86·0, SB 50·0, ASB 28·0, PSB 157·0, SD 185·0, A–P 50·0, AL 39·0, PL 42·0, Sens. 33·6 with head 14/22.
Gahrliepia (*Gateria*) *romeri* sp. n.

24. Scutum roughly pentagonal, i.e. margin behind PL forming a strong angle. Scutum and coxae strongly punctate. Coxae III 1-setose. DS 2.12[6].9[3].8.6.4.4.2.

AW 51·0, PW 85·0, SB 51·0, ASB 26·0, PSB 116·0, SD 142·0, A–P 34·0, AL 40·0, PL 57·0, Sens. — (after Radford).
Gahrliepia (*Gateria*) *longipilis* (Radford 1946).

Scutum not pentagonal 25

25. Scutum smaller, ca. half as long again as wide, widest about middle and posterior of PL. DS 2.6[4].4[2].2[2].6.4.4.4.2. SD smaller than 120μ.

AW 43·0, PW 73·0, SB 41·5, ASB 17·0, PSB 99·5, SD 116·5, A–P 35·0, AL 18·0, PL 18·0, Sens. ? (after Gater; and Womersley and Heaslip. *Gahrliepia* (*Gateria*) *rutila* Gater 1932.

Scutum larger, ca. twice as long as wide. SD. greater than 180μ .. 26

26. Scutum widest in posterior third, with 10 additonal setae, all but 2 placed submarginally.

    AW 40·0, PW 70·0, SB 42·0, ASB 30·0, PSB 159·0, SD 189·0, A–P 53·0, AL 45·0, PL 38·0, Sens. ? (after Gater; and Womersley and Heaslip). *Gahrliepia* (*Gateria*) *ciliata* Gater 1932.

    Scutum widest elsewhere, with more than 10 additional setae, which are not mainly submarginal 27

27. Dorsal scutum widest just behind PL, with margins posterior of widest part lightly concave. With normally 12 additional scutal setae (variable from 9 to 14), arranged ca. 2.4[4].8[4].6[2].6.6.4.4.2.

    AW 51·9±4·2, PW 77·7±7·3, SB 46·7±4·2, ASB 25·2, PSB 163·8±6·7, SD 188·8±7·6, A–P 41·3±3·7, AL 37·3±6·5, PL 40·8±6·7, Sens. —. *Gahrliepia* (*Gateria*) *spinulosa* (Radford 1946)

    Dorsal scutum widest at the middle and well behind PL, with 16 additional setae. DS 2.4[4].10[8].4[2].6[2].6.8.4.2.

    AW 52·0, PW 79·0, SB 50·0, ASB 18·0, PSB 170·0, SD 188·0, A–P 39·0, AL 50·0, PL 37·0, Sens. ? (after Gater; and Womersley and Heaslip). *Gahrliepia* (*Gateria*) *fletcheri* Gater 1932.

GAHRLIEPIA (WALCHIA) MOROBENSIS (Gunther 1939).

Walchia morobensis Gunther 1939. Proc. Linn. Soc. New South Wales, 64 (1–2), 94; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 135.

Plate 76, fig. A–C.

This species was originally described by Gunther from 4 specimens from *Rattus browni* and many from *R. ringens* from Bulolo, New Guinea.

As diagnosed the species was chiefly characterized by the scutal margins not being defined. A careful re-examination of Gunther's type in the collection of the Australian Museum, Sydney, shows that at least the anterior and lateral margins can be seen, and possibly also the posterior margin.

In the specimens recorded herewith and referred to this species the scutal margins can be plainly seen, especially in fresh or remounted specimens using the polyvinyl alcohol media.

The species, on the basis of the type and the new material, can be characterized by the AL, SB and PL being almost in the same longitudinal line, although often the distance between the PL setae is somewhat greater than between SB and between AL. The posterior margin forms rather an acute angle, as in the figure. The palpal claw is bifurcate and all the setae on the

palpal femur, genu and tibia except the ventral on the tibia are nude. The sensillae are clavate, with the head strongly setulose and the apex acuminate. All the coxae are unisetose. Eyes absent, or only indistinctly 1 + 1. The dorsal setae are 2.6.6.6.4.2. There is no long nude seta on tarsi III.

In 1943 Womersley and Heaslip (*loc. cit.*) gave the Standard Data for the type and one paratype as: AW 25·0, 25·0, PW 25·0, 25·0, SB 25·0, 27·0, ASB 16·5, 17·0, PSB 16·5, —, A–P 33·0, 34·0, AL 20·0, 18·0, PL 31·0, 30·0, Sens. 25·0, 25·0. The value of PSB 16·5 was only an estimate as at that time, the scutal margins could not be clearly seen.

Through the kindness of Lt.-Col. J. R. Audy and his assistant T. J. Lawrence, I have been able to study a large amount of Trombiculid material from S. Burma, and have isolated 16 specimens which can be referred to *morobensis* Gunther. These were mainly from *Nesokia bengalensis* and *Rattus rattus* from Toungoo, and neighbourhood, Oct. 1944.

The Standard Data derived from 14 of these 16 specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	29·5±0·60	2·24±0·42	22·8–36·2	25·6–32·0	7·6
PW	32·9±0·90	3·36±0·63	22·8–43·0	25·6–38·4	10·2
SB	28·1±0·40	1·50±0·28	23·6–32·6	24·0–28·8	5·3
ASB	19·2±0·53	1·98±0·37	13·3–25·1	17·6–20·8	10·3
PSB	44·0±0·36	1·37±0·25	39·9–48·1	41·6–44·8	3·1
SD	63·2±0·40	1·50±0·28	58·7–67·7	60·8–65·6	2·4
A–P	35·4±0·28	1·06±0·20	32·2–38·6	33·6–38·4	3·0
AL	27·4±0·65	2·42±0·46	20·2–34·6	22·4–28·8	8·8
PL	29·5±0·48	1·79±0·34	24·2–34·8	25·6–32·0	6·0
Sens.	25·6 with head 9·6/19·2. No variation recorded.				

GAHRLIEPIA (WALCHIA) RUSTICA Gater 1932.

Gahrliepia rustica Gater 1932, Parasitology, 24, 167.

Walchia rustica, Womersley and Heaslip 1943. Tr. Roy. Soc. S. Aust., 67, (1), 136; Sig Thor and Willmann 1947, Das Tierreich, 71b, 337.

Plate 76, fig. D–F.

This species was originally described from *Rattus surifer surifer* (Miller) from Selangor, Federated Malay States.

It differs from the closely allied species, *turmalis* Gater in having the dorso-apical tooth of the tricuspid cap on the chelicerae pointed and directed backward, hook-like, not blunt; in having fewer dorsal setae, 38–40 instead of 40–44, and in the somewhat wider but shorter scutum. The palpal claw is

trifurcate, and all the setae on the femur, genu and tibia of palpi nude. Gater states that the seta on the third segment (*genu*) sometimes has one or two barbs. The dorsal setae are 40 and arranged 2.6.8.8.6.4.4.2. The sensillae are clavate and setulose. Eyes apparently absent.

The paratype specimen in the collection of the South Australian Museum has been re-mounted and the Standard Data re-determined as follows: AW 41·6, PW 51·2, SB 32·0, ASB 17·6, PSB 48·0, SD 65·6, A–P 32·0, AL 28·0, PL 30·8, Sens. —.

No specimens which can be referred to this species have been seen amongst the large amount of Burma material that I have been able to study, nor does the species appear to have been recorded from anywhere since the original discovery.

In addition to the above paratype three other paratypes from Gater's collection at Kuala Lumpur, have been sent to me for study by Dr. J. R. Audy. In the Standard Data these specimens do not differ significantly from the above, the values without variation being: AW 42·0, PW 50·8, SB 31·0, ASB 18·0, PSB 48·0, SD 66·0, A–P 30·0, AL 30·0, PL 30·0, Sens. —.

This species has recently been found commonly on *Rattus r. jarak* on Palau Jarak Is., in the Malacca Straits, by Dr. J. R. Audy and his team, and I have been privileged to study a large series collected 26th Jan. 1950. Of about 40 or more specimens, 16 have been measured and the following Standard Data determined:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	36·6±0·26	1·04±0·18	33·5–39·7	36·0–39·0	2·8
PW	44·5±0·22	0·87±0·15	41·9–47·1	42·0–45·0	2·0
SB	29·7±0·20	0·79±0·14	27·3–32·1	27·0–30·0	2·6
ASB	19·7±0·37	1·49±0·26	15·2–24·4	18·0–21·0	7·5
PSB	44·1±0·35	1·39±0·24	39·9–48·3	42·0–45·0	3·1
SD	63·75±0·30	1·21±0·21	60·15–67·35	63·0–66·0	1·9
A–P	35·7±0·33	1·32±0·23	31·7–39·7	33·0–39·0	3·7
AL	30·0	No variation recorded			
PL	30·0	No variation recorded			
Sens.	Lost in remounting.				

These specimens, although having slightly lower Standard Data than shown by Gater's Selangor material agree in all morphological characters. From the closely allied *G.* (*W.*) *turmalis* this species is distinct in the more pronounced tricuspid apical cap of the chelicerae, the fewer dorsal setae, and the smaller scutum with PSB equal to or less than PW.

GAHRLIEPIA (WALCHIA) TURMALIS Gater 1932.

Gahrliepia turmalis Gater 1932, Parasitology, 24, 168.

Walchia turmalis, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 136; Radford 1946, Parasitology, 37, 48; Sig Thor and Willmann 1947, Das Tierreich, 71b, 337.

Plate 76, fig. G–I.

This species, which is closely allied to the preceding one but differs as pointed out under that species, was originally described from *Rattus sabanus vociferans* (Miller) from Selangor, Federated Malay States.

Radford 1946, recorded it from the Musk Shrew (*Suncus caeruleus giganteus* (Geoffy.) from Colombo, Ceylon.

It is a very common and widely distributed species in Southern Burma on such hosts as *Rattus rattus, R. norvegicus concolor,* and *Nesokia bengalensis,* as evidenced by the very large number of specimens found amongst the material I have been able to examine. The localities include Ron, Insein, Paungola, and Toungoo.

The palpal claw is apparently trifurcate and the setae on palpal femur, genu and tibia all plain or nude. The sensillae (missing in all of Gater's material) are as in *rustica,* clavate and setulose. Gater's statement, "The setae on the hypostome are plain or serrate instead of plumose as in most other species" is puzzling. If he refers to what are now known as the "galeal setae" then these are plain or nude in most known species of *Gahrliepia,* but if he means the maxillary setae, I know of no species of Trombiculidae in which these are other than branched. The dorsal setae are from 40–44, and arranged 2.6.6.6.6.6.6.4(2).2(0).

The Standard Data as derived from 151 specimens from Southern Burma are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	38·35±0·12	1·38±0·08	34·2–42·5	35·2–41·6	3·6
PW	48·6±0·17	2·10±0·12	42·3–54·9	44·8–56·0	4·3
SB	32·4±0·12	1·48±0·08	28·0–36·8	28·8–35·2	4·6
ASB	22·5±0·04	0·50±0·03	21·0–24·0	22·4–25·6	2·2
PSB	56·7±0·20	2·43±0·14	49·4–64·0	48·0–64·0	4·3
SD	79·4±0·21	2·60±0·15	71·6–87·2	70·4–86·4	3·3
A–P	40·65±0·12	1·49±0·08	36·2–43·1	38·4–44·8	3·6
AL	32·9±0·13	1·62±0·09	28·0–37·8	28·8–38·4	5·0
PL	32·6±0·12	1·47±0·08	28·2–37·0	28·8–35·2	4·5
Sens.	32·0 with head 9·6/22·4. No variation recorded.				

GAHRLIEPIA (WALCHIA) LEWTHWAITEI (Gater 1932).

Walchia lewthwaitei Gater 1932, Parasitology, 24, 170; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 135; Sig Thor and Willmann 1947, Das Tierreich, 71b, 336.

Plate 76, fig. J–L.

This species was described from 9 specimens from *Rattus rattus* (probably *diardi* Jentink) from Kuala Lumpur, Federated Malay States.

It does not appear to have been recorded from elsewhere, nor have I detected the species amongst the large amount of *Gahrliepia* material from Southern Burma.

The species may be separated as in the key, by the very small scutum, the globose and not clavate sensillae and the normally 6-setose coxae III. The palpal claw is trifurcate and the setae on the palpal femur, genu and tibia all nude. Eyes apparently absent. Dorsal setae short, 34 to 40 in number and arranged ca. 2.6.6.6.6.4.2.2.

The Standard Data of a specimen from the Institute of Medical Research, Kuala Lumpur, and collected from *R. rattus* from Sungei Buloh, F.M.S., 15th Oct., 1940, as given by Womersley and Heaslip (1943) are: AW 17·0, PW 31·5, SB 17·0, ASB 17·0, PSB 21·5, SD 38·5, A–P 28·0, AL 11·5, PL 15·0, Sens. —.

The Standard Data derived from 20 specimens of a large number from *Rattus whiteheadi* and *R. mulleri* from Selangor and Temerloh, Pahang, F.M.S., collected by J. R. Audy and his colleagues 1948, are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	19·5±0·15	0·70±0·11	17·4–21·6	16·8–21·0	3·6
PW	31·65±0·21	0·93±0·15	28·9–34·4	30·8–33·6	2·9
SB	17·25±0·22	0·99±0·16	14·25–20·25	16·8–19·6	2·7
ASB	19·3±0·19	0·84±0·13	16·8–21·8	16·8–19·6	4·3
PSB	28·0	No variation recorded			
SD	47·3±0·19	0·84±0·13	44·8–49·8	44·8–47·6	1·8
A–P	30·4±0·22	1·00±0·16	27·4–33·4	28·0–30·8	3·2
AL	14·0	No variation recorded			
PL	14·0	No variation recorded			
Sens.	19·6 with head 11/14. No variation recorded.				

The setation of coxae III in this population shows a slight variation from the normal 6 + 6 setae; of the twenty specimens measured three had 5 + 5 setae on coxae III and one had 6 + 5, the rest being normally 6 + 6.

GAHRLIEPIA (WALCHIA) DISPARUNGUIS (Ouds. 1929).

Schöngastiella disparunguis Oudemans 1929, Ent. Ber., 7, (165), 398; Sig Thor and Willmann 1947, Das Tierreich, 71b, 335.

Walchia disparunguis, Womersley 1944, Tr. Roy. Soc. S. Aust., 68, (1), 101.

Plate 76, fig. M–P.

This species was originally described from specimens from the ears of *Mus rattus* var. from Garoet (W. Java), Aug., W. C. van Heuren.

Oudemans' original description translated, reads as follows: "Length of a moderately engorged specimen 225μ, greatest breadth 145μ. Scutum rounded-pentagonal with one angle directed posteriorly; in each of the other four angles a seta. On each shoulder is a seta and behind the scutum five rows of six setae in each. Pseudostigmal organ clavate, the stem about one-third of its length. Dorsal setae about 30μ long, brush-like and shortly ciliated. Eyes small, cornea half spherical. Venter: all coxae (also maxillae) with a feathered seta; coxae III with two such. Between coxae I and between coxae III a pair of similar setae. Then 17 pairs of setae similar to the dorsal setae. Gnathosoma dorsally with 6 pairs of smooth setae; ventrally with more; externally on the tibiae with short smooth seta, and on the very short and difficult to see palpus are four setae of which one is short thick rod-like olfactory seta, the other three are short thick setae distally divided into four or five branches. Palpal claw bifid."

Oudemans was rather uncertain about placing this species in *Schöngastiella* Hirst as it differed from Hirst's diagnosis in having only 4 setae besides the sensillae on the scutum instead of three pairs. He also noticed that the scutum resembled that of *Typhlothrombium* Ouds. 1910 (= *Gahrliepia* Ouds. 1912) although in his description it is suggested that the posterior is sharply defined, not tongue-like as in *Gahrliepia* (Womersley and Heaslip 1943) and similar to *Walchia.* He also was of the opinion that the shape of the scutum was a specific and not a generic character. Oudemans also refers to the disparity in the form and size of the 3 tarsal claws and named his species on this character. This feature, in which the median claw (empodium) is much stronger than the others and of median length, the outer longer and only slightly more slender, and the inner only slightly shorter than the median but much thinner is, however, present in all the species of *Gahrliepia* known to me, and I believe a good generic character. This species is closely related to *glabra* Walch, but can be easily distinguished as in the key, on the bi-setose coxae III and the shape of, and number of setae on, the scutum.

This species has not been recorded apparently since its description but that it is widespread in the Asiatic-Pacific area is evident from the following specimens which I have been able to examine.

Ceylon, 4 specimens from *Millardia mellada* from Embilipitiya, Oct., 1944, and 3 specimens from *Rattus rattus kandiyanus* from Nalanda, Nov., 1944 (S. H. Jayewickreme); Dutch New Guinea, Sansapor, 37 specimens from Aug. to Dec., 1944 (C. Mohr); Borneo, Labuan, 4 specimens from rats, Oct., 1945 (R. N. McC.); Celebes, Morotai, 2 specimens from rats, Oct., 1945 (R. N. McC.); Southern Burma. On *Nesokia bengalensis*, Ron, 10 Oct., 1945 (747); on *Rattus rattus*, Toungoo, 23 Oct., 1945 (771); on *N. bengalensis*, Toungoo, 29 Oct., 1945 (765), and on *N. bengalensis*, Toungoo, 26 Oct., 1945.

The Standard Data for this species as derived from the Dutch New Guinea specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	27·45±0·26	1·60±0·18	22·65–32·25	24·0–28·8	5·8
PW	44·6±0·27	1·62±0·19	39·75–49·45	41·6–48·0	3·6
SB	23·3±0·21	1·26±0·15	19·5–27·1	22·4–25·6	5·4
ASB	20·3±0·21	1·29±0·15	16·5–24·1	19·2–22·4	6·3
PSB	36·1±0·25	1·53±0·18	31·55–40·65	32·0–38·4	4·2
SD	56·4±0·25	1·53±0·18	51·8–61·0	54·4–59·2	2·7
A–P	32·8±0·23	1·42±0·16	28·5–37·1	30·4–35·2	4·3
AL	22·4	No variation recorded			
PL	28·8	No variation recorded			
Sens.	25·6 with head 9·6/19·2. No variation recorded.				

A re-description of the larvae is as follows:

Shape an elongate oval, slightly constricted behind coxae III. Size small, length (engorged) to 380μ, width to 250μ. Scutum small, pentagonal, produced to a rounded point posterior of PL; furnished only with AL and PL setae and paired sensillae; sensillae fairly broadly clavate with prominent setules; anterior margin lightly concave. Eyes 2 + 2, the posterior smaller and indistinct. Chelicerae non-serrate, with the usual tricuspid cap. Galeal setae nude. Palpi fairly stout, tibial claw bifurcate; all setae on palpal femur, genu and tibia nude; tarsi with the usual basal and apical sensory rods and 3–4 ciliated setae. Dorsal setae 36 in number, to 25μ with only short ciliations and arranged ca. 2.6.6.2(lateral).6.6.4.2.2. Ventrally with a pair of ciliated setae on gnathosoma, a pair between coxae I and between coxae III, one on each of coxae I and II, two on coxae III, and thereafter 14.12.12.6.4.2. to 20μ long. Legs rather short, I 180μ, II 150μ, III 210μ; tarsi I and II with the usual sensory rods; III without any long nude seta.

GAHRLIEPIA (WALCHIA) EWINGI (Fuller, 1951), (= GLABRUM Walch, 1927, preoc.)

Trombicula glabrum Walch 1927, Geneesk. Tijdsch. v. Ned. Indie, 67, (6), 926.

Walchia glabrum, Ewing 1931, Proc. U.S. Nat. Mus., 80, (8), 10; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67 (1), 134; Womersley 1944, Tr. Roy. Soc. S. Aust., 68, (1), 134.

Walchia glabra, Sig Thor and Willmann 1947, Das Tierreich, 71b, 336; Fuller 1948, Bull. Brooklyn, Ent. Soc., 43, (4), 110.

Walchia pingue Gater 1932, Parasitology, 24; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 134; Womersley 1944, Tr. Roy. Soc. S. Aust., 68, (1), 102.

Walchia pinguis, Sig Thor and Willmann 1947, Das Tierreich, 71b, 338.

Plate 76, fig. Q–T.

This species was originally described from rats from the Lampong District of Macassar, and in 1943 Womersley and Heaslip identified 3 unidentified specimens from *Rattus rattus argentiventer* Chasen, from Perak sent to them from the Institute of Medical Research, Kuala Lumpur, and one specimen (I, A, I.C., IV) from Batavia, as the same.

In 1944 the species was recorded by myself from 7 specimens collected in the Buna area of New Guinea by G. M. Kohls and the Standard Data given. The Standard Data of 3 specimens from Perak, 10 from Buna, N.G. and 24 received more recently from Dr. R. Gispen, from Batavia, from *Rattus rattus diardi* are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	28·4±0·18	1·08±0·12	25·2–31·6	25·6–30·4	3·8
PW	48·8±0·48	2·94±0·34	40·0–57·6	43·2–54·4	6·0
SB	25·0±0·20	1·20±0·14	21·4–28·6	22·4–25·6	4·8
ASB	22·4	No variation recorded			
PSB	34·3±0·23	1·42±0·16	30·0–38·6	32·0–35·2	4·1
SD	56·7±0·23	1·42±0·16	52·4–61·0	54·4–57·6	2·5
A–P	36·7±0·45	2·72±0·32	28·6–44·8	32·0–38·4	7·4
AL	22·4	No variation recorded			
PL	28·8	No variation recorded			
Sens.	28·8 with head 11·2/22·4. No variation recorded.				

This species is closely related to the following, *enode* Gater, but differs in the larger scutum and particularly in the number of setae on coxae III. In *glabra,* coxae III carries normally 3 setae, and shows extremely little variation

in this respect; of the 37 specimens examined only two show more than three setae, on one of each coxae III, these having 3 + 4 setae. In *enode* the setae on coxae III while normally 4 + 4, show a very great variation from 4 + 3 to 5 + 6. Where, however, specimens of the latter species have only 4 + 3, the size of the scutum, the Standard Data and the dorsal setae will fairly easily determine the species.

In *glabra* the palpal claw is bifurcate and the setae on the palpal femur, genu and tibia, and on the galea are nude. The dorsal setae are 2.6.6.6.6.4.2.

From Gater's description of *pingue* there seems little doubt that it is identical with *glabra*. It has not been recognized since Gater's paper nor have any specimens that could be referred to it been seen amongst the large amount of material studied in the preparation of this paper. Its synonymy with *glabra* is confirmed by a study of one of Gater's two specimens, kindly sent to me by Dr. J. R. Audy.

GAHRLIEPIA (WALCHIA) ENODE (Gater 1932).

Walchia enode Gater 1932, Parasitology, 24, 169, (*enodis*); Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 135; (*enodis*) Radford 1946, Proc. Zool. Soc. London, 116, (2), 247; Sig Thor and Willmann 1947, Das Tierreich, 71b, 338.

Plate 76, fig. U–X.

This species which was originally described from Sungei Buloh, Selangor, Malaya, from *Rattus mulleri validus* (Miller) does not appear to have been recorded since.

It is, however, a very common and widely distributed species in Southern Burma as shown by the large number of specimens amongst the Trombiculid material collected by Lt.-Col. J. R. Audy and his staff of the S.E.A.C. Scrub Typhus Research Team, and submitted to me for identification.

As stated under *G. glabra* Walch, the present species is closely related thereto, differing in the smaller scutum, the dorsal setae and particularly a different and more variable number of setae on coxae III.

In the 191 specimens for which the Standard Data is given, the setation of coxae III varied as follows: 3 + 4, 21 specimens (11·0%); 3 + 5, 2 specs. (1·6%); 4 + 4, 119 specs. (62·3%); 4 + 5, 35 specs. (18·3%); 4 + 6, 1 spec. (0·7%); 5 + 5, 12 specs. (6·3%); 5 + 6, 1 spec. (0·8%). Thus the normal is 4 + 4. Where the setae on coxae III are 4 + 3, as in *glabra*, the size of the scutum and its Standard Data will be determinative.

The sensillae are capitate and setulose and their bases somewhat nearer to PL than to AL. The palpal claw is apparently, and the setae on the palpal femur, genu and tibia as well as the galeal setae, nude. The chelicerae has only the usual apical tricuspid cap. Eyes apparently absent. The dorsal setae vary from 32–34 and are arranged ca. 2.8.6.6.4.4.2.

The following Standard Data are from 189 specimens, plus a specimen from Sungei Buloh, Selangor, 8 Aug. 1930 from *Rattus mulleri validus* (Miller) and one specimen received from Radford from *Rattus* sp. Imphal, Manipur, 10 June, 1945.

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	26·5±0·10	1·45±0·07	22·1–30·9	22·4–32·0	5·5
PW	37·6±0·15	2·13±0·11	31·2–44·0	35·2–51·2	5·7
SB	21·0±0·10	1·44±0·07	16·6–25·4	17·6–25·4	6·8
ASB	18·9±0·06	0·78±0·04	16·6–21·2	17·6–22·4	4·1
PSB	32·75±0·14	1·97±0·10	26·8–38·7	28·8–35·2	6·0
SD	52·0±0·15	2·03±0·10	46·0–58·0	48·0–57·6	3·9
A–P	30·95±0·10	1·36±0·07	26·85–35·05	28·8–35·2	4·4
AL	19·2±0·06	0·78±0·04	16·9–21·5	16·0–25·6	4·0
PL	20·7±0·10	1·39±0·07	16·6–24·8	19·2–22·4	6·7
Sens.	22·4 with head 12·8/16·0. No variation recorded.				

In Southern Burma it occurs commonly on *Nesokia bengalensis* and the various species of *Rattus*.

GAHRLIEPIA (WALCHIA) BRENNANI sp. n.

Plate 112, fig. A–D.

Description of Larvae. Size small. Shape oval. Length (engorged) to 335μ, width to 254μ. Scutum as figured and approximately of the size and shape of *G.* (*W.*) *turmalis* Gater; with only AL and PL setae; sensillae clavate and setulose. Eyes apparently absent. Chelicerae with only the apical tricuspid cap. Galeal setae nude. Palpal claw bifurcate; setae on femur, genu and tibia apparently all nude. Dorsal setae 32–34 in number, to 30μ long, shortly and sparsely ciliated, and arranged 6(4).6.6.6.6.2.2, i.e., normally with 3 + 3 humeral setae, but frequently only 2 + 2. Ventrally with a pair of setae on maxillae, a pair between coxae I and between coxae III, one on each of coxae I and coxae II, two on coxae III; posterior of coxae III ca. 36 setae to 26μ long. Legs: I 200μ long, II 174μ, III 200μ; tarsi I and II with dorsal sensory rod, III without a long nude seta.

Standard Data derived from the type and 16 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	37·5±0·30	4·0±0·21	33·5–41·5	36·85–40·2	3·6
PW	54·1±0·36	4·8±0·25	49·3–58·9	53·25–56·95	2·9
SB	32·8±0·42	5·6±0·29	27·2–38·4	30·15–36·85	5·7
ASB	21·8	No variation recorded.			
PSB	57·8±0·32	4·3±0·23	53·5–62·1	56·95–60·3	2·5
SD	79·6±0·32	4·3±0·23	75·3–83·9	78·75–82·1	1·9
A–P	37·6±0·30	4·0±0·21	33·6–41·6	36·85–40·2	3·5
A L	27·3±0·27	3·6±9·10	23·7–30·9	26·8–30·15	4·4
PL	26·8	No variation recorded.			
Sens.	33·5 with head 10·05/23·45. Only 1 determination.				

Loc. and Hosts. The type and sixteen paratypes from a "ground squirrel" *Rhinosciurus laticaudatus* from Kepong Forest Reserve, Selangor, F.M.S., 11 Sept., 1950 (Scrub Typhus Research Unit). Also 1 specimen from *Rattus bowersi* from Ulu Langat, Selangor, F.M.S. 13 June, 1950.

Remarks. In the shape of the scutum and the Standard Data, this species is very close to *G.* (*W.*) *turmalis* Gater. It is strikingly different, however, in having coxae III normally bisetose, and in having 2–3 humeral setae on each side. It is named in honour of Dr. J. M. Brennan, of the Rocky Mountain Laboratory, Hamilton, Mont., U.S.A., who has described many American species of Trombiculidae.

var. VENTRALIS nov.

Three specimens with the above material differ rather remarkably in that coxae III are unisetose, and ventrally between coxae II and coxae III are from 3 to 4 setae somewhat shorter than the dorsal humeral setae. Coxae II and III are correspondingly wider apart than in the typical form.

In Standard Data these 3 specimens agree with the typical specimens. For the moment, as in all these 3 specimens the sensillae are missing, they are regarded as a distinct variety.

The 3 specimens were from *R. bowersi* but from the Ulu Langat Forest Reserve, Selangor, F.M.S., 13 June, 1950.

GAHRLIEPIA (? WALCHIA) RIOI Gunther 1940.

Gahrliepia rioi Gunther 1940, Proc. Linn. Soc. New South Wales, 65, (5–6), 481.

Plate 77, fig. A.

This species has not been recognized since its original description. According to Gunther's description and figures the dorsal scutum is distinctly produced beyond the PL setae; tongue-shaped, but with only the AL and PL setae; its

posterior end is slightly concave and SB are much nearer to PL than to AL. The sensillae were missing from Gunther's material. The chelicerae are simple, with only the usual tricuspid cap, and the galeal setae are nude. The palpal claw is trifurcate. The seta on the palpal femur is nude; on the genu with one long branch, and on the tibia one long branched seta (this is probably the ventral, the dorsal and lateral not having been seen). The dorsal setae number 28, and are arranged 2.6.6.6.4.2.2. All coxae 1-setose; except III which are 2-setose; posteriorly of coxae III ca. 36 setae.

The Standard Data as deduced by Womersley and Heaslip (1943) from Gunther's data are: AW 30·0, PW 50·0, SB 25·0, ASB 18·0, PSB 58·0, SD 76·0, A–P 24·0, AL 28·0, PL 40·0, Sens. —.

It was described from specimens from the mouse deer, *Tragulus borneanus* from the Bode River, British North Borneo, Sept., 1939.

GAHRLIEPIA (SCHÖNGASTIELLA) LIGULA (Radford 1946).

Schöngastiella ligula Radford 1946, Proc. Zool. Soc. London, 116, (2), 256.

Plate 77, fig. B–F.

Radford described this species from *Rattus rattus rufescens* (Gray) from Imphal, Manipur State, India, 6th May, 1945.

This species is very common in Southern Burma on various rats and on *Nesokia bengalensis*. I have been privileged to study some hundreds of specimens from various localities such as Ron, Prome, Toungoo, Insein, and Tharrawaddy, collected by Lt.-Col. J. R. Audy and his team in 1945.

As Radford's description is somewhat brief a fresh and more detailed one is given below.

Shape oval with a tendency to constriction just posterior of coxae III. Length (engorged) to 560μ, width to 320μ. Scutum elongate, ligulate behind PL and in addition to AL and PL carrying the two median setae of the second dorsal row; because of its narrow ligulate posterior part these two additional setae are near to the apex and close together. Eyes apparently absent. The sensillae are clavate (as stated by Radford and not globose as shown in his figure 17) and setulose. Palpi small tibial claw apparently trifurcate; all setae on palpal femur, genu and tibia nude. Chelicerae with only the apical tricuspid cap. Galeal setae nude. Dorsal setae 48, to 35μ long and arranged 2.8[2].8.4.8.6.6.4.2. Ventrally with the usual pair of ciliated setae on the maxillae, one on each coxa, a pair between coxae I and between coxae III and posterior of coxae III ca. 56 setae. Legs: I 210μ, II 190μ, III 240μ; tarsi I and II with the usual dorsal sensory rod, III without a long nude seta.

The Standard Data derived from 48 specimens from S. Burma are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	36·8±0·27	1·88±0·19	31·2–42·4	33·6–39·2	5·1
PW	51·9±0·33	2·29±0·23	45·0–58·8	44·8–56·0	4·4
SB	35·6±0·22	1·56±0·16	30·9–40·3	33·6–39·2	4·4
ASB	26·5±0·20	1·39±0·14	22·4–30·6	25·2–28·0	5·2
PSB	65·5±0·46	3·21±0·33	55·9–75·1	61·6–72·8	4·9
SD	92·0±0·53	3·70±0·38	80·9–103·1	86·8–100·8	4·0
A–P	44·7±0·25	1·72±0·17	39·5–49·9	42·0–47·6	3·8
AL	42·0±0·15	1·07±0·11	38·8–45·2	39·2–44·8	2·5
PL	42·0	No variation recorded			
Sens.	33·6 with head 14·0/25·2. No variation recorded.				

G. (*S.*) *ligula* (Radford) is also a common species in Kashmir and I have recently received much material from Maj. S. L. Kalra, collected from ears of rats, and from a shrew during 1948 and 1949 from the following localities: Kanzalwan, Jhanghar, Gurais, Srinagar, Naushera and Banital.

GAHRLIEPIA (SCHÖNGASTIELLA) CEYLONICA sp. n.

Plate 77, fig. G–L.

Description of Larvae. Shape oval, but with a marked constriction behind the third pair of legs. Colour in life unknown. Length to 545μ, width to 350μ. Dorsal scutum elongate, widest in line with sensillae, slightly narrower between PL than between AL; posterior of PL narrowing to form a long narrow lip-like projection which subapically takes in the median pair of setae of the second dorsal row; sensillae globose, finely setulose, the bases about midway between AL and PL. Eyes not observed. Chelicerae with only the apical tricuspid cap. Palpi stout, all setae on femur, genu and tibia apparently nude. Galeal setae nude. Palpal claw bifid. Dorsal setae to 28μ long, 36 in number and arranged 2.6[2].8.8.6.4.2. Ventral setae more numerous and shorter than on dorsum; one on coxae I and II, four on coxae III, a pair between coxae I and between coxae III and thereafter ca. 8.8.8.8.8.6.4.2. Legs: I 156μ long, II 130μ, III 143μ; tarsi I and II with usual dorsal rod-like seta, III without any long nude seta.

The Standard Data for the type larva are: AW 31·0, PW 28·0, SB 23·0, ASB 14·0, PSB 55·0, SD 69·0, A–P 28·0, AL 20·0, PL 20·0, Sens. 20·0 with head 14/14.

Loc. and Hosts. Type from *Rattus r. kandiyanus* from Nalanda, Ceylon, May, 1944 (S.H.J.) and 4 paratypes from *Leggada booduga fulvidiventris* from same locality May 1944 (S.H.J.). Two specimens also from a "mouse" from Nanshera, Kashmir, India, 14th May, 1949 (G. L. Kabra).

Remarks. In the peculiar ligulate form of the dorsal scutum this species is close to *Schöngastiella ligula* Radford. It differs, however, in the scutal dimensions, the arrangement of the dorsal setae and especially in having 4 setae on each coxae III, instead of the one seta in Radford's species.

The larvae have been reared through to the nymphs which are described later in this paper.

GAHRLIEPIA (SCHÖNGASTIELLA) BREVIS (Radford 1946).

Schöngastiella brevis Radford 1946, Proc. Zool. Soc. London, 116, (2), 256.

Plate 78, fig. A.

This species was described from a specimen (or ? specimens) from a rat *Rattus r. rufescens* (Gray) from Imphal, Manipur State, India, 7 May, 1945. Although the scutum of this species, as figured by Radford has a roughly pentagonal shape and is prolonged posteriorly to include the 2 median setae of the second dorsal row, it is very wide, almost as much so as it is long. The sensillae are missing, but the bases are closer to AL than to PL. The dorsal setae number 28, and are arranged 2.6[2].6.6.2.4.2. Posterior of coxae III ventrally ca. 42 setae. Coxae I and II 1-setose, III 2-setose. Eyes apparently absent. Mouth parts and palpi not described.

The Standard Data (after Radford) are: AW 44·0, PW 86·0, SB 51·0, ASB 26·0, PSB 78·0, SD 104·0, A–P 43·0, AL 38·0, PL 41·0. Sens. —.

This species has not been recorded, nor has any fresh material come to hand, since its original discovery.

GAHRLIEPIA (SCHÖNGASTIELLA) BENGALENSIS (Hirst 1915).

Schöngastiella bengalensis Hirst 1915, Bull. Ent. Res., 6, fig. 7, 8; Ewing 1938, J. Wash. Acad. Sci., 28, (6), 295; Sig Thor and Willmann 1947, Das Tierreich, 71b, 334.

Gahrliepia bengalensis, Womersley and Heaslip, 1943, Tr. Roy. Soc. S. Aust., 67, (1), 140.

Plate 78, fig. B.

In this species described from specimens in the ears of *Mus. rattus,* Calcutta, 20 Mar., 1915, the dorsal scutum is tongue-shaped, but rather quickly narrowing posterior of PL to the rounded apex, and taking in two of the median setae of the second dorsal row. According to Hirst's figure there are two, comparatively large, eyes on each side. The chelicerae are apparently simple with only the apical tricuspid cap. The palpal tibial claw is shown in the figure as bifurcate. The setae on the palpal femur, genu and tibia are all

nude. All coxae are 1-setose. The dorsal setae number 38, and are arranged 2.6[2].8.8.6.4.2.2. Ventrally posterior of coxae III ca. 36 in number and shorter than the dorsal setae.

To this species are now referred three specimens, two from a rat, from Thunia, Burma, 17 Dec., 1946 (J. R. Audy) and one from a rat from Ranikhet, Burma, 20 Oct., 1946 (J.R.A.).

The Standard Data for one specimen from Thunia and the one from Ranikhet are: AW 38·4, 38·4, PW 51·2, 51·2, SB 35·2, 35·2, ASB 16·0, 16·0, PSB 70·4, 64·0, SD 86·4, 80·0, A–P 35·2, 38·4, AL 38·4, 38·4, PL 35·2, 35·2. Sens. —.

These values are somewhat lower in some items than those given by Womersley and Heaslip 1943, which were derived by interpolation from Hirst's figure.

It should be noticed that in Hirst's figure the sensillae bases are about half-way between AL and PL, whereas in the fresh material as figured they are definitely nearer to AL than to PL.

More recently I have been able to examine a number of specimens of this species collected in Kashmir by Maj. S. L. Kalra, as well as two specimens from Burma. Of these the Kashmir specimens were 5 from Kanzalwan, 10–11 Oct., 1946, and 4 from Tithwal, Sept., 1946. The two Burma specimens were from Thunia, 17 Dec., 1946 (J. R. Audy) and Raniket, 20 eDc., 1946 (J.R.A.).

The Standard Data for these eleven specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	36·7±0·47	1·55±0·33	32·0–41·4	34·0–39·0	4·2
PW	50·6±0·69	2·17±0·48	44·1–57·1	46·0–54·0	4·2
SB	31·7±0·80	2·66±0·57	23·7–39·7	28·0–35·0	8·4
ASB	21·1±0·81	2·70±0·57	13·0–29·2	16·0–24·0	12·8
PSB	58·1±1·69	5·02±1·13	43·1–73·1	54·0–70·0	8·6
SD	79·2±0·97	3·08±0·69	70·0–88·4	75·0–86·0	3·9
A–P	37·6±0·52	1·65±0·37	32·7–42·5	35·0–39·0	4·4
AL	31·45±0·97	3·23±0·67	21·75–41·15	30·0–38·0	10·2
PL	35·8±0·15	0·44±0·10	34·5–36·1	35·0–36·0	1·2
Sens.	33·0 with head 15/21. Only one determination.				

GAHRLIEPIA (SCHÖNGASTIELLA) PUNCTATA (Radford 1946).

Schöngastiella punctata Radford 1946, Proc. Zool. Soc. London, 116, (2).

Plate 78, fig. C.

This species was described from a shrew *Suneus* (*Crocidura*) *caeruleus fulvocinereus* (Anderson) from Kanglatongbi, Imphal, Manipur State, 20 April, 1945.

To it are now referred 12 specimens from Southern Burma, collected in 1945 by T. J. Lawrence.

The dorsal scutum is fairly large, roughly pentagonal with the posterior angle well produced and taking in 2 extra setae from the second dorsal row. The sensillae are situated nearer to AL than to PL, are clavate and setulose with their bases wide apart. The eyes are 2 + 2, anterior very distinct, and posterior the smaller. Dorsal setae 2.6[2].6.6.4.2.2. Coxae III bisetose and ventrally posterior of coxae III ca. 40 setae. Scutum and coxae strongly punctate. The galeal setae and the setae on palpal femur are lightly branched, on genu and tibia nude. Palpal claw apparently bifurcate.

The Standard Data for the above 12 specimens coll. No. 62 (4 specs.), 458 (1 spec.) and 122 (7 specs.) are as follows:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	45·2±0·69	2·37±0·48	38·1–52·3	41·6–51·2	5·2
PW	68·5±1·27	4·41±0·90	55·3–81·7	60·8–73·6	6·4
SB	43·5±0·73	2·54±0·52	35·9–51·1	38·4–44·8	5·9
ASB	22·7±0·27	0·92±0·19	19·9–25·5	22·4–25·6	4·1
PSB	91·5±2·82	9·78±2·00	62·2–120·8	80·0–102·4	10·7
SD	114·1±2·77	9·58±1·96	85·3–142·9	102·4–124·8	8·4
A–P	44·9±0·64	2·20±0·45	38·3–51·5	41·6–48·0	4·9
AL	38·4	No variation recorded			
PL	38·4	No variation recorded			
Sens.	35·2 with head 9·6/22·4. No variation recorded.				

In addition to the above specimens I have also one from Thunia, Burma, 16 Dec., 1946 (J.R.A.) and one from *Millardia millardia* from Embilipitiya, Ceylon, Jan., 1945 (S. H. Jayewickreme).

GAHRLIEPIA (SCHÖNGASTIELLA) KUMAONENSIS sp. n.

Plate 78, fig. D–G.

This species is described from a single specimen from a shrew from Bhimtal, in the Kumaon Hills, India, 10 Oct., 1946 (S. L. Kalra).

The species is close to *bengalensis* Hirst and *punctata* Radford but differs as in the key in the Standard Data, shape of the scutum, dorsal setae, and the 4-setose coxae III. In the last character it agrees with *saduski* sp. n. from Japan but differs in the other above-mentioned characters.

Description of Larvae. Shape an elongate oval, length (engorged) 420μ, width 350μ. Scutum fairly large, roughly pentagonal, widest in line of PL with the posterior angle produced and taking in two of the six setae in the second dorsal row. Sensillae missing, bases nearer AL than PL. Chelicerae normal, with only the usual apical tricuspid cap. Galeal setae nude. Palpi

fairly stout, tibial claw bifid; setae on palpal femur, genu and tibia all nude. Eyes apparently absent. Dorsal setae strongly ciliated, 32 in number and arranged 2.6[2].6.6.6.4.2. to 36μ long. Ventrally with the usual pair of branched maxillary seta, one setae on each of coxae I and II, four setae on coxae III; behind coxae III with ca. 40 setae. Legs: I 216μ long, II 182μ, III 238μ; tarsi I and II with the usual sensory rod, III without any long nude seta.

The Standard Data of the type, in the South Australian Museum are: AW 51·2, PW 76·8, SB 49·6, ASB 28·0, PSB 110·0, SD 138·0, A–P 51·2, AL —, PL 41·6, Sens. —.

GAHRLIEPIA (GAHRLIEPIA) SADUSKI sp. n.

Plate 78, fig. H–J.

Description of Larvae. Shape broadly oval. Length (engorged) to 550μ, width to 450μ. Scutum as figured, comparatively small, tongue-shaped, widest about in line of PL, and besides the AL and PL setae embracing the median 4(2–5) setae of the second dorsal row which itself is variable. Sensillae clavate with pronounced setules, and their bases wide apart and nearer to AL than to PL. Eyes apparently absent. Chelicerae simple, with only the usual apical tricuspid cap. Galeal setae nude. Palpi with trifurcate tibial claw with the prongs closely adpressed; setae on palpal femur with 4–5 strong branches, on genu with 2–3, on tibia the dorsal and lateral setae nude, and the ventral with 3 long branches; tarsi with the usual basal and apical sensory rods and 4–5 ciliated setae. Dorsal setae strongly ciliated, ca. 32 in number and arranged ca. 2.8[4].9[2–5].6.3.6.5.3, to 50μ long. Ventrally with a pair of branched setae on maxillae of palpi, one on each coxa I and II, and 4 setae on coxae III, a pair between coxae I and between coxae III, thereafter ca. 36 in number to 40μ long. Legs: I 235μ long, II 210μ, III 230μ; tarsi short, I and II with the usual dorsal sensory rod, III without any long nude seta.

The Standard Data for 7 of 8 specimens are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	48·9±0·59	1·56±0·42	44·2–53·6	48·0–51·2	3·2
PW	63·5±0·83	2·21±0·59	56·9–70·1	60·8–67·2	3·5
SB	41·4±0·23	0·60±0·16	39·6–43·2	40·0–41·6	1·5
ASB	22·4	No variation recorded			
PSB	65·4±0·65	1·71±0·46	60·3–70·5	64·0–67·2	2·6
SD	87·8±0·65	1·71±0·46	82·7–92·9	86·4–89·6	1·9
A–P	38·4	No variation recorded			
AL	35·65±0·46	1·21±0·32	31·25–40·05	35·2–38·4	3·4
PL	35·2	No variation recorded			
Sens.	38·4 with head 12·8/25·6. No variation recorded.				

Loc. and Hosts. The type and 2 paratypes from *Mus.* sp. from Misinobe, near Yachi, Yamagata Prefecture, Japan, 28 Oct., 1945 (C. B. Philip); four other specimens from Niigata, Japan, 18 Oct., 1945, embedded in the belly of *Microtus montebelli,* and a further specimen from the latter host and locality, January, 1946 (coll. T. O. Berga).

I am greatly indebted to Col. C. B. Philip for the opportunity of describing this material.

Remarks. This species can be separated from all others on the shape of the dorsal scutum, the additional setae thereon, and on the 4-setose coxae III. In the number of additional scutal setae it is somewhat variable, and of the eight specimens examined 3 had 4 in addition to AL and PL, 3 had 2, 1 had 3 and 1 had 5. The number of setae on coxae III did not vary.

GAHRLIEPIA (GAHRLIEPIA) INSIGNE, sp. n.

Plate 79, fig. A–D.

Description of Larvae. Shape oval. Length (partially engorged) 338μ, width 182μ. Scutum elongate, tongue-like, with large reticulations which are roughly square to hexagonal; sensillae missing but bases in front of line of PL; AM shorter than PL but similarly thick and ciliated. Eyes 2 + 2, very small and close to scutal margin just anterior of PL. Palpi stout with bifurcate tibial claws of which the prongs are about equal and long; setae of femur very shortly ciliated, of genu the same, of tibia all 3 apparently nude. Chelicerae simple with only the usual apical cap. Galeal setae nude. Dorsal setae generally strong and thickly ciliated, 32 in number, from 42μ long anteriorly to 36μ posteriorly, arranged 2.6[2].6[2].6.6.4.2, those on the scutum are thinner than the outer and the scutal setae. Ventrally, with paired fine and ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, thereafter ca. 56, very short and fine. Legs: 1 7-segmented, II and III 6-segmented; I 220μ long, II 195μ, III 260μ; coxae of leg III are broad and short, almost rectangular; tarsi I and II with the usual dorsal rod, III without any long nude seta.

The Standard Data for the unique type are: AW 44·6, PW 75·6, SB 44·6, ASB 22·4, PSB 173·6, SD 196·0, A–P 30·8, AL 39·2, PL 53·2, Sens. —; the maximum width of scutum is 98μ.

Loc. and Host. The unique type from *Tupaia glis,* from Pahang Rd., Gombak Forest Reserve, near Kuala Lumpur, F.M.S., 18 Oct. 1948 (J.R.A.).

Remarks. A very striking species, but closely allied to the two following in having an ornamented scutum. It differs, however, in the type of scutal orna-

mentation and in the size of scutum and the position of SB in front of line of PL.

This, and the following two species, in having four additional setae on the posteriorly produced scutum, agree with the type *G. nanus* (Ouds.), and thus, if subgenera are accepted fall into *Gahrliepia* s. str. Oudemans' species does not possess such strongly ornate scutum as in *insigne, decora* and *ornata* but is shown by Oudemans as very strongly punctate.

GAHRLIEPIA (GAHRLIEPIA) DECORA sp. n.

Plate 80, fig. A–D.

Description of Larvae. Shape broadly oval. Length (partially engorged) to 410μ, width 350μ. Scutum large and tongue-shaped, with many large but not touching, rounded, depressions in between which the surface is finely pitted or shagreened; sensillae missing in all specimens, but sensillae bases well behind line of PL; PL comparatively near to AL; AL short and fine, PL very long, thick and strongly ciliated. Eyes 2 + 2, small and lenticular, close to margin of scute. Palpi stout, tibial claw long and bifurcate, prongs subequal; seta on femur and genu lightly and shortly branched, on tibia dorsal and lateral nude but ventral doubtful. Chelicerae simple, with only the apical tricuspid cap. Galeal setae nude. Dorsal setae long, thickly ciliated and tapering from 92·0μ long (humeral) to 36·0μ posteriorly, 34 in number, arranged ca. 2.6.6[2].6[2]. 4.4.2.2.2, those on the scutum rather shorter than the outer. Ventrally with paired branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 56 setae, to 30μ long. Legs: I 7-segmented, II and III 6-segmented; tarsi I and II with dorsal sensory rod, III without any long nude seta. Coxae finely pitted and III large and triangular.

The Standard Data for the type and 6 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	41·6±0·40	1·06±0·28	38·4–44·8	39·2–42·0	2·5
PW	66·8±0·73	1·93±0·52	61·0–72·6	64·4–70·0	2·9
SB	30·8	No variation recorded			
ASB	22·4	No variation recorded			
PSB	239·6±3·99	10·57±2·82	207·9–271·3	224·0–257·6	4·4
SD	262·0±3·99	10·57±2·82	230·3–293·7	246·4–280·0	4·0
A–P	17·2±0·73	1·93±0·52	11·4–23·0	14·0–19·6	11·2
AL	26·8±0·56	1·50±0·40	22·3–31·3	25·2–28·0	5·6
PL	108·8±1·55	4·10±1·09	96·5–121·1	103·6–112·0	3·8
Sens.	Missing.				

Loc. and Hosts. The type and 6 paratypes from *Rattus sabanus,* from Pahang Rd., Gombak Forest Reserve, near Kuala Lumpur, F.M.S. 15 Nov., 1948 (J.R.A.).

Remarks. Allied to the preceding species in the ornamental dorsal scutum but distinguished therefrom as in the key and as stated under that species.

GAHRLIEPIA (GAHRLIEPIA) ORNATA sp. n.

Plate 81, fig. A–D.

Description of Larva. Shape broadly oval. Length (partially engorged) 416μ, width 286μ. Scutum ornamented, as figured; with PL very much longer and stronger than AL and situated very close thereto, and in front of SB; sensillae missing. Eyes not observed. Chelicerae with only the apical tricuspid cap. Galeal setae nude. Palpi as figured, with bifurcate tibial claw; seta on femur and genu branched, on tibia all nude except ventral. Dorsal setae thick, long and strongly ciliated, 2.4[2].8[2].8.8.8.6, to 84–60μ long; the extra scutal setae 56μ long and more slender. Ventrally with paired ciliated setae on maxillae, one on each coxa, a pair between coxae I, two rows of 4 each between coxa III, and thereafter 8.8.8.2.10.2.2, from 20 to 42μ long. Scutum and coxae finely punctate. Legs: I 286μ long, II 260μ, III 325μ; coxae III large and triangular; tarsi I and II with dorsal sensory rod, III without any long nude seta.

The Standard Data for the unique type are: AW 40·0, PW 59·0, SB 33·6, ASB 25·2, PSB 218·4, SD 243·6, A–P 12·0, AL 28·0, PL 98·0, Sens. —.

Loc. and Host. A single specimen from *Rattus sabanus* from Ulu Langat Forest Reserve, Kuala Lumpur, 18 Nov., 1949 (J.R.A.).

Remarks. Close to *G. (G.) decora* sp. n. and *G. (G.) insigne* sp. n. in the ornamental scutum and the peculiarly shaped coxae III. Closest to *decora* in having PL in front of SB, but distinguished by the ornamentation, the dorsal setae, and the Standard Data.

GAHRLIEPIA (GAHRLIEPIA) CETRATA Gater 1932.

Gahrliepia cetrata Gater 1932, Parasitology, 24; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 140; Sig Thor and Willmann 1947, Das Tierreich, 71b, 338.

Plate 82, fig. A.

This species has apparently not been met with since it was originally described from 13 specimens from the ears and around the anus of *Rattus edwardsi ciliatus* (Bonhote) (coll. A. K. Cosgrove, 25 Apr., 1930). The dorsal scutum is longer than wide and the posterior prolongation takes in the two

median setae of both the second and third dorsal rows. The sensillae are clavate and setulose, with their bases about midway between AL and PL. The PL setae are the longest. Eyes are stated by Gater to be just visible near the scutal margins, posterior eyes the smaller. The chelicerae are apparently simple with only the usual apical tricuspid cap. Galeal setae nude. The palpal claw is trifurcate and the seta of palpal femur with a few barbs, of genu rarely so, of the tibia the dorsal and lateral are nude and the ventral with a few barbs. The dorsal setae are 36, arranged 2.6[2].6[2].6.6.4.4.2.

The Standard Data as deduced by Womersley and Heaslip (1943) from Gater's data are: AW 42·0, PW 90·0, SB 49·0, ASB 35·0, PSB 155·0, SD 190·0, A–P 65·0, AL 40·0, PL 55·0, Sens. 37·0 with head 12/30.

GAHRLIEPIA (GATERIA) HIRSUTA (Radford 1946).

Gateria hirsuta Radford 1946, Proc. Zool. Soc. London, 116, (2).

Plate 82, fig. B–D.

The description of the paratype which I have received from Radford is as follows:

Shape oval. Length (partially engorged) 270μ, width 180μ. Dorsal scutum pentagonal, much longer than wide, lateral margins concave slightly, posterior margin forming a deep triangle, PL setae anterior of SB and adjacent to AL at the antero-lateral corners. SB wide apart, with sensillae clavate and setulose; posteriorly the scutum takes in the whole four setae of the second dorsal row, the median 2 of the 4 setae in the third row, and the median 2 of the 6 in the fourth row. The chelicerae are simple with only the usual apical tricuspid cap. Galeal setae ciliated. Eyes apparently absent. Palpal with tibial claw trifurcate, with the prongs closely adpressed; setae on palpal femur and genu shortly branched; on tibia all 3 setae nude. The dorsal setae number 34, arranged 2.4[4].4[2].6[2].6.4.4.2.2. to 50μ long. Ventrally with the usual pair of branched setae on maxillae, one on each coxa, a pair between coxae I and between coxae III and thereafter ca. 44–46, to 30μ long. Legs: I 240μ long, II 220μ, III 270μ; tarsi I and II with the usual dorsal sensory rod; III without any long nude seta.

The Standard Data are: AW 42·0, PW 57·0, SB 42·0, ASB 21·0, PSB 112·0, SD 133·0, A–P 12·0, AL 45·0, PL 58·0, Sens. 32·0 with head 9/25.

Loc. The specimen examined above is labelled as from a mole, from Kanglatongbi, Manipur, 22 June (C. D. Radford).

Remarks. This species is remarkable in the manner in which PL has moved forward to adjoin AL at or near to the antero-lateral corners of the scutum. In Radford's own figure the PL setae are actually shown as being

lateral of AL, in the above specimen they are slightly but distinctly posterior of AL.

From the above description it will be seen that I do not agree with Radford's interpretation that there are 2 AL setae on each side of the scutum. The outermost of each such pair I regard as the PL setae which have migrated forward in an unusual manner. This is supported by the fact that they are much longer than the other scutal and dorsal setae, a feature which is generally common in the family.

Radford gives the Standard Data measurements as: AW 57·0, PW 68·0, SB 50·0, ASB 23·0, PSB 119·0, SD 142·0, A–P 45·0, AL 72·0, PL 48·0, Sens. 34·0, which in general, although somewhat higher agree reasonably well with my measurements as given in the key except that his AL corresponds to my PL, and his PL I consider to be one of the DS embraced by the scutum. My AL is his second AL which he gives as 54·0μ long and in his figure is shown as being slightly inside but closely adjacent to his first AL (my PL).

It was described from a shrew *Suncus* (*Crocidura*) *caeruleus fulvocinereus* (Anderson) from Kanglatongbi, Imphal, Manipur, 29 April, 1945. A second specimen was recorded by Radford from the same host and locality, June 21, 1945, and 13 specimens from a mole from the same locality, 22 June, 1945.

I have also examined another specimen, Coll. No. 61, from S. Burma (J. R. Audy), which has an extra pair of additional setae on the scutum, i.e. 6 besides AL and PL. Even in Radford's paratype referred to above there are 5 additional setae as figured here. It would appear that the setal counts of the second and third rows are somewhat variable in this species.

The Standard Data of this specimen are: AW 38·4, PW 54·4, SB 41·6, ASB 22·4, PSB 108·8, SD 131·2, A–P 9·6, AL 41·6, PL 64·0, Sens. —.

The peculiar situation of the PL setae in this species, and also in other undescribed material, has suggested to some of my American colleagues that they should be generically separated. As, however, the nymph of this species is known to me, and cannot be separated, except specifically, from other *Gahrliepia* species, the raising of a new genus is unwarranted.

GAHRLIEPIA (GATERIA) LANCEARIA (Radford 1946).

Gateria lancearia Radford 1946, Proc. Zool. Soc. London, 116, (2), 256.

Plate 82, fig. E.

Radford described this species from a specimen (or ? specimens) found on a mole *Talpa micrura* Hodgeson, at Kanglatongbi, Imphal, India, 22 June, 1945. It does not appear to have been met with since.

From Radford's figure and brief description the chief characteristic

appears to be the stoutly lanceolate, not clavate, sensillae with strong ciliations. The scutum is fairly large, roughly pentagonal, with the posterior angle well produced and taking in 4 setae from the second dorsal row and 2 from the third. The sensillae bases are at about midway between AL and PL. The dorsal setae number 44 and are arranged 2.8(4).8(2).8.8.6.4. Ventrally and posterior of coxae III ca. 56 setae. Coxae all 1-setose. No particulars of palpi and mouthparts are given.

The Standard Data as given by Radford are: AW 51·0, PW 85·0, SB 51·0, ASB 27·0, PSB 119·0, SD 146·0, A–P 35·0, AL 44·0, PL 68·0, Sens. 40·0.

GAHRLIEPIA (GATERIA) LONGIPILIS (Radford 1946).

Gateria longipilis Radford 1946, Proc. Zool. Soc. London, 116, (2).

Plate 82, fig. F.

This species does not appear to have been met with since Radford described it from a shrew, *Suncus* (*Crocidura*) *caeruleus fulvocinereus* (Anderson) from Imphal, Manipur State, India, 8 May, 1945. No specimens were found amongst the large amount of material which I have been able to study from Burma.

The dorsal scutum is strongly punctate, elongate pentagonal and taking in 6 of the twelve setae in the second dorsal row, and 3 of the nine in the third row; the dorsal rows of setae are strongly curved forwards. Sensillae missing. All coxae are 1-setose and strongly punctate. Posterior of coxae III ca. 56 setae. Dorsal setae 2.12[6].9[3].8.6.4.4.2 = 47.

The Standard Data (after Radford) are: AW 51·0, PW 85·0, SB 51·0, ASB 26·0, PSB 116·0, SD 142·0, A–P 34·0, AL 40·0, PL 57·0, Sens. —.

GAHRLIEPIA (GATERIA) CROCIDURA (Radford 1946).

Gateria crocidura Radford 1946, Proc. Zool. Soc. London, 116, (2).

Plate 82, fig. G.

No fresh records of this species have been published, nor have any specimens been detected amongst the large amount of Burma material submitted to me.

The following figure and details are derived from those of Radford.

Scutum elongate pentagonal, punctate; the apex produced as a long triangle with rounded lip, and taking in the median 4 setae of the second dorsal row, and the median 2 of the third row. The dorsal setae number 48, and are arranged 2.8[4].8[2].8.8.6.4.4. Ventrally all coxae are 1-setose and posterior of coxae III there are 58 setae. No details of the palpi and mouthparts are available.

The Standard Data as given by Radford are: AW 51·0, PW 85·0, SB 51·0, ASB 27·0, PSB 119·0, SD 146·0, A–P 36·0, AL 44·0, PL 57·0, Sens. —.

The species was described from a shrew *Suncus* (*Crocidura*) *caeruleus fulvocinereus* (Anderson) from Imphal, Manipur State, India, 8 May, 1945.

GAHRLIEPIA (GATERIA) ROMERI sp. n.

Plate 83, fig. I.

Description of Larva. Shape broadly oval, sides rather flattened. Length (engorged), 624μ, width 540μ. Scutum finely punctate as figured, strongly produced behind line of PL and taking in 6 extra setae of the second and third dorsal rows; SB wide apart and about midway between AL and PL; widest part behind line of PL (and dorsal setae) shortly ciliated. Eyes 2 + 2, small. Chelicerae with only the apical tricuspid cap. Galeal setae nude. Palpi with bifurcate tibial claw; setae on femur and genu nude, on tibia ventral only branched. Dorsal setae 36 in number, arranged 2.8[4].6[2].6.6.4.2.2, from 42 to 36μ long. Ventrally with a pair of ciliated setae on maxillae, a pair between coxae I and between coxae III, one on each coxa, those on coxae III long to 56μ, after coxae III with ca. 54 setae from 22–36μ long. Legs I and II with dorsal sensory rod on tarsi; no long nude seta on tarsi III; I 260μ long, II 234μ, III 273μ.

The Standard Data for the unique type are: AW 50·0, PW 86·0, SB 50·0, ASB 28·0, PSB 157·0, SD 185·0, A–P 50·0, AL 39·0, PL 42·0, Sens. 33·6 with head 14/22.

Loc. and Host. A single specimen from *Rattus rattus*, from Hong Kong, 1950 (J. D. Romer).

Remarks. This species is very near to, and may only be a variant of *G. crocidura* Radford. It appears to differ, however, in the Standard Data, particularly the larger PSB and A–P, the position of SB, and in the smaller number of dorsal setae.

GAHRLIEPIA (GATERIA) RUTILA Gater 1932.

Gahrliepia rutila Gater 1932, Parasitology, 24; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 138.

Gateria rutila, Ewing, 1938, J. Wash. Acad. Sci., 28, 295; Sig Thor and Willmann, 1947, Das Tierreich, 71b, 340.

Plate 83, fig. A–C.

Gater described this species from 7 specimens from *Rattus mulleri validus* (Miller) from Sungei Buloh, Federated Malay States, and also recorded two specimens from *R. edwardsi ciliatus* (Bonhote) from Pahang (coll. A. K. Cosgrove, 25 April, 1930).

Dorsal scutum very large and tongue-like, taking in 4 of the six setae in the second dorsal row, 2 of the four in the third row and the 2 setae which can be considered as constituting the fourth row, i.e. it carries 12 setae in all; the maximum width of the scutum occurs rather posterior of the line of PL. The sensillae are unknown, but their bases are slightly nearer AL than PL. The chelicerae are simple with only the usual apical tricuspid cap. Galeal setae nude. Eyes present but small. Palpi small, tibial claw trifurcate; all setae on femur, genu and tibia nude. Dorsal setae short and barbed, 34 in number, arranged 2.6[4].4[2].[2].6.4.4.4.2.

The Standard Data as deduced from Gater's data by Womersley and Heaslip (1943) are as follows: AW 43·0, PW 73·0, SB 41·5, ASB 17·0, PSB 99·5, SD 116·0, A–P 35·0, AL 18·0, PL 18·0, Sens. —. Max. width 83·0.

GAHRLIEPIA (GATERIA) CILIATA Gater 1932.

Gahrliepia ciliata Gater 1932, Parasitology, 24; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 140.

Gateria ciliata, Ewing 1938, J. Wash. Acad. Sci., 28, 295; Sig Thor and Willmann, Das Tierreich, 71b, 339.

Plate 83, fig. D.

This species was described from a single specimen only from *Rattus mulleri validus* (Miller) from Sungei Buloh, Federated Malay States.

Dorsal scutum very large, and broadest at about one-fourth from the posterior end, and taking in all the four setae of the second dorsal row and 2 of the four in the third, fourth and fifth rows. According to Gater the palpal claw is trifurcate; the setae on the palpal femur, genu and tibia all nude; the chelicerae are simple with only the usual apical tricuspid cap, and the galeal setae are nude; eyes present 2 + 2, the posterior the smaller; dorsal setae 36 in number and arranged 2.[4].4[2].4[2].4[2].6.4.2.4.2

The Standard Data from Gater's figure and data as computed by Womersley and Heaslip 1943 are: AW 40·0, PW 70·0, SB 42·0, ASB 30·0, PSB 159·0, SD 189·0, A–P 53·0, AL 45·0, PL 38·0, Sens. —.

GAHRLIEPIA (GATERIA) SPINULOSA (Radford 1946).

Gateria spinulosa Radford 1946, Proc. Zool. Soc. London, 116, (2), 252.

Plate 83, fig. E.

This species was described from a shrew *Suncus* (*Crocidura*) *caeruleus fulvocinereus* (Anderson) from Imphal, Manipur State, India, 8 May, 1945.

Amongst the material collected by T. J. Lawrence from Southern Burma (slide No. 60) is a single specimen which belongs to Radford's species. It has the following Standard Data: AW 48·0, PW 76·8, SB 48·0, ASB 25·5, PSB 160·0, SD 185·6, A–P 32·0, AL 32·0, PL 35·2, Sens. —. The dorsal setae are 2.4[4].8[4].8[4].6[1].6.6.4.2, i.e. 13 additional setae on the scutum.

Recently received from J. R. Audy from host No. 7,074 (unspecified) from Bukit Lagong, Kepong, Kuala Lumpur, 13/1/50 are 12 specimens also of this species.

From this material the following details are now given:

The scutum is large, elongate, with sparse punctations. It is widest behind PL, but the sides are initially slightly concave behind PL, and posteriorly the margin becomes rounded. In the typical form the scutum carries 12 additional setae, but this number is variable. In Lawrence's Burma specimens there are 13, while in the series of 12 specimens from Malaya, the number varies from 8 to 14 with an average of 11·4. The higher number of 14 might suggest a variant of *Gahr.* (*Gateria*) *fletcheri* Gater which typically has 16 additional scutal setae and a scutum of about the same length and width. In *fletcheri*, however, the arrangement of scutal setae is different, the greatest width is midway of the scutal length and the sides behind PL are evenly convex.

The palpal claw is trifurcate; the seta on the femur with indistinct barbs, on the genu nude, on the tibia all nude except the ventral which is apparently branched. The eyes are 2 + 2, the larger anterior being distinct, the posterior more or less vestigial. The chelicerae with only the apical tricuspid cap. Galeal setae nude. All coxae 1-setose.

The Standard Data for the 12 specimens from Malaya are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	51·9±0·40	1·39±0·28	47·7–56·1	50·4–53·2	2·7
PW	77·7±0·70	2·42±0·59	70·4–85·0	72·8–81·2	3·1
SB	46·7±0·40	1·38±0·28	42·5–50·9	44·8–47·6	2·9
ASB	25·2	No variation recorded			
PSB	163·8±0·64	2·23±0·46	157·1–170·5	162·4–168·0	1·2
SD	188·8±0·73	2·52±0·50	181·2–196·4	184·8–193·2	1·3
A–P	41·3±0·36	1·24±0·25	37·6–45·0	39·2–42·0	3·0
AL	37·3±0·63	2·18±0·44	30·8–43·8	33·6–39·2	5·8
PL	40·8±0·64	2·22±0·45	34·1–47·5	36·4–42·0	5·4
Sens.	Missing in all specimens.				

GAHRLIEPIA (GATERIA) FLETCHERI Gater 1932.

Gahrliepia fletcheri Gater 1932, Parasitology, 24; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 140.

Gateria fletcheri, Ewing 1938, J. Wash. Acad. Sci., 28, (6), 298; Sig Thor and Willmann 1947, Das Tierreich, 71b, 339.

Plate 83, fig. F–H.

This species was described by Gater from numerous specimens from *Rattus rattus diardi* (Jentink), Kuala Lumpur, F.M.S. He also recorded it from Sungei Buloh, from *Rattus sabanus vociferans* Miller, *Sciurus caniceps concolor* Blyth, *Tupaia glis ferruginea* Raffles, and *Rhinosciurus tupaiodes laticaudatus.*

For this species, and to include also Gater's *ciliata* and *rutila* Ewing 1938 erected the genus *Gateria,* stressing that it was not the number of setae on the scutum, but the fact that some of the setae are not marginal, which was important. He restricted *Gahrliepia* to the type species *nana* Ouds. from Africa, with 4 pairs of normal scutal setae and retained *bengalensis* Hirst, with 3 pairs of scutal setae in *Schöngastiella,* in disagreement with Gater. In 1943, Womersley and Heaslip showed, however, that any scutal setae posterior of PL could be attributed to members of the dorsal rows, embraced by the prolongation of the scutum; and as this is the most natural and logical interpretation it seems better to retain them all in *Gahrliepia.*

In this species the dorsal scutum is very large, tongue-shaped, much longer than wide, and from the paratype in the South Australian Museum, takes in all the 4 setae of the second dorsal row, 8 of the ten of the third row, 2 of the four of the fourth row, and 2 of the six of the fifth row. (Gater states that the number of setae on the scutum is somewhat variable.) There are 2 eyes on each side fairly close to the scutum. AL setae longer than PL. Sens. clavate and setulose with bases wide apart but nearer to AL than to PL. Chelicerae simple with only the usual apical tricuspid cap. Galeal setae nude. Palpal claw trifurcate, the prongs closely adpressed. The setae on the palpal femur and genu have a few inconspicuous barbs; on tibia all 3 setae nude. The dorsal setae number ca. 46, arranged 2.4[4].10[8].4[2].6.8.4.2. The Standard Data of the paratype as given by Womersley and Heaslip 1943 are: AW 52·0, PW 79·0, SB 50·0, ASB 18·0, PSB 170·0, SD 188·0, A–P 39·0, AL 50·0, PL 37·0, Sens. —. Max. width of scutum 100·0

ADULTS AND NYMPHS.

While this paper is essentially a Monograph on the "Trombiculidae of the Asiatic-Pacific Region" it has become necessary, to properly evaluate, at least, some of the many larval genera which have been proposed, to consider all the adults and nymphs described from the whole world. Consequently in this section, the world species (relatively few compared with the described larval forms), are all dealt with, both descriptively and, as far as possible, with those of which material has not been available for study, by previously published figures. One species, *Trombicula signata* Womersley 1938, described as belonging to the genus *Trombicula* Berl. s.l. does not belong to the Trombiculidae, but is a species of *Podothrombium*.

The genera as known from adults or nymphs belong to both subfamilies, the Trombiculinae and the Gahrliepiinae, and may be keyed as follows:

Key to the Adult and/or Nymphal Subfamilies and Genera of the TROMBICULIDAE S. Str.

1. Tarsi I simple without any dorsal subapical stump-like process .. 2

   Subfam. *Trombiculinae* Ewing 1944.

   Tarsi I subapically with a short dorsal stump-like process. Sensillary area of crista wider than long, with the anterior rod shorter than distance between sensillae bases. Eyes absent. Epistome rounded or conical with fine denticulations and 1 ciliated seta. No precoxal plates and no definite sternum.

   Subfamily *Gahrliepiinae* nom. nov.
   for *Walchiinae* Ewing 1931.
   Gen. *Gahrliepia* Ouds. 1912.
   (type *Typhlothrombium nanus* Ouds. 1910)
   = *Walchia* Ewing 1931
   (type *Trombicula glabrum* Walch 1922)
   incl. *Schöngastiella* Hirst and *Gateria* Ew.

2. Eyes distinctly present, one on each side 3

   Eyes entirely absent or vestigial and without lenses, at most represented by pigment spots 5

3. Eyes placed well away from and in front of sensillary area. Epistome rounded and subtriangular, denticulate, with 1 ciliated seta.

Sternum well defined and formed by fusion of precoxal plates of leg I, entire, without longitudinal division, wider than long.

Gen. *Tragardhula* Berl. 1912.
(type *Trombidium niloticum* Trag. 1904 (adult)).
= *Blankaartia* Berl. 1912 (*non* Ouds. 1911) (adult)
= *Pentagonella* Sig Thor 1936 (larva).
(type *Trombidium ardeae* Trag. 1904).
= *Megatrombicula* Michener 1947 (adult)
(type *Trombicula alleei* Ewing 1926).

Eyes placed closely adjacent to sensillary area 4

4. Front tarsi elongate-clavate, with the greatest height distad of middle. Body form elongate. Crista flask-shaped, without ? an areola in sensillary area; anterior rod of crista shorter than distance between sensillae bases; a strong ciliated seta on crista just anterior of sensillary area. Epistome a transverse rectangle, anterior margin dentate, one ciliated seta. Sternum entire, no precoxal plates.

Gen. *Ipotrombicula* nov.
(type *Trombicula elegans* Womersley 1942) (adult).

Front tarsi tapering, with greatest height basad of middle. Body form squatter. Crista with anterior rod longer than distance between sensillae bases; subposterior sensillary area roughly diamond-shaped, with an internal somewhat dumb-bell shaped areola; sensillae filamentous: no seta on crista in front of sensillary area. Epistome a transverse rectangle or rounded-conical, with dentate margin and 1 ciliated seta. Sternum entire, about as long as wide, no precoxal plates.

Gen. *Trombicula* Berl. 1905 (adult) in part.
(type *Trombicula minor* Berl. 1905)
(incl. *Eutrombicula* Ewing 1938)

Subgen. *Trombicula* Berl. 1905, s. str.

5. Legs I much longer than others, and than the body. Form more elongate. Claws strong, on legs I apically furcate. Palpal tibia in adult with only 1 accessory spine at base of claw. Epistome a transverse rectangle with dentate margin and I seta, which apparently has only 1 short branch. Sternum entire; no precoxal plates.

Gen. *Speotrombicula* Ewing 1946 (adult).
(type *Trombicula trifurca* Ewing 1946).

Legs all shorter than body. Form squatter. Claws normal 6

6. Sensillary area of crista much wider than long, with anterior rod shorter than distance between sensillae bases. Precoxal plates present on coxae I.

Gen. *Guntherana* Wom. and Heasp. 1943.
(type *Neoschöngastia bipygalis* Gunther 1939).

Sensillary area of crista about as wide as long, with anterior rod much longer than distance between sensillae bases. Precoxal plates on coxae 1 present or absent 7

7. Sensillary area entire, not divided into sections by longitudinal ridges, reniform with hilus directed forwards, with more or less circular striae. Sensillae spathulate, sometimes almost filiform.

Gen. *Neoschöngastia* Ewing 1929 (larva).
(type *Schöngastia americana* Hirst 1921).
= (*Paraschöngastia* Wom. 1939) (larva).

Sensillary area not as above 8

8. Sensillary area of crista triangular with apex directed posteriorly. Epistome rounded or conical with fine dentations and 1 ciliated seta.

Gen. *Schöngastia* Ouds. 1905 (larva)
(type *Thrombidium vandersandei* Ouds. 1905)
(incl. *Ascoschöngastia* Ewing 1946).

Sensillary area more or less diamond-shaped.

Gen. *Trombicula* Berl. 1905 (in part) 9

9. Precoxal plates of coxae I well developed, fused in the medial line to form a longitudinally divided sternum.

Subgen. *Leptotrombidium* Nagayo *et al.* 1917 (adult)
(type *Trombidium akamushi* Brumpt. 1910).

Precoxal plates absent. Sternum entire, undivided.

Subgen. *Neotrombicula* Hirst 1925 (nymph).
(type *Acarus autumnalis* Shaw 1790).

Subfamily TROMBICULINAE Ewing 1944.

This family is characterized as defined by Ewing 1944b and 1946, in that the anterior dorsal scutum of the larvae has a single median seta present on the anterior margin. In the present work it is separated in the adult and nymphal stages from the Gahrliepiinae (= Walchiinae) in that there is no dorsal subapical clavate process on the front tarsi. It contains the following adult genera: *Tragardhula* Berl. 1912, *Trombicula* Berlese 1904, (subgenera *Leptotrombidium* Nagayo *et al.* 1917 and *Neotrombicula* Hirst 1926), *Speotrombicula* Ewing 1946, *Ipotrombicula* Wom. g. nov. *Schöngastia* Oudemans 1905, separated as in the preceding key.

Genus TRAGARDHULA Berl. 1912

Tragardhula Berl. 1912, Redia, 8, (1), 4 (type *Trombidium niloticum* Trag. 1904, adult).

Blankaartia Berl. 1912, *ibid.* 96, *non* Oudemans, 1911.

Pentagonella S. Thor 1936, Zool. Anz., 114.

Megatrombicula Michener 1946, Ann. Ext. Soc. Amer., 39, 431–445.

The status and synonymy of this genus has recently been discussed by the author (Tr. Roy. Soc. S. Aust., 72, (1), 1948).

Key to the Known Adult Species.

1. Palpal tibia with a pectine of 8–17 spines on inner surface. Tarsi I ca. 3 times as long as high, 540μ × 170μ, metatarsus I 350μ long. Dorsal setae to 155μ long.
Trag. velascoi (Boshell and Kerr, 1942).

   Palpal tibia without a pectine, with only the usual 3 accessory spines near base of claw 2

2. Dorsal setae with apices devoid of ciliations. *Trag. peruviana* (Ewing 1926).

   Dorsal setae ciliated to tips 3

3. Tarsi I parallel sided, more than 4 times as long as high, 370μ × 80μ, metatarsus I 300μ long. Dorsal setae to 70μ.
Trag. attenuata (Mich. 1946).

   Tarsi I not parallel sided 4

4. Tarsi I ca. twice as long as high, 325μ × 163μ, metatarsi I 247μ long. Dorsal setae to 65μ. *Trag. acuscutellaris* (Walch 1922).

   Tarsi I more than twice as long as high 5

5. Dorsal setae to 160μ long. Tarsi I nearly 3 times as long as high, 350μ ×130μ, metatarsi I 250μ long. *Trag. alleei* (Ewing 1926).

   Dorsal setae much shorter.

6. Tarsi I ca. 3 times as long as high, 102·5μ × 32·8μ, metatarsus I 65·6μ. Dorsal setae 25μ to 58μ. (Nymph, after Tanaka).
Trag. japonica (Tanaka 1916).

   Tarsi I ca. 3·5 times as long as high, 370μ × 110μ, metatarsus I 270μ. Dorsal setae 30–40μ long. *Trag. nilotica* (Ouds. 1904).

TRAGARDHULA NILOTICA (Trag. 1904 adult).

Trombidium niloticum Tragardh 1904, Res. Swed. Zool. Exped. Egypt and White Nile, 1901, No. 20, 80 (adult, *non* larva).

Tragardhula nilotica Berl. 1912, Redia, 8, 4 (adult); Sig Thor and Willmann, 1947, Das Tierreich, Lfg. 71 b., 353.

Blankaartia nilotica Berl. 1912, Redia, 8, 96 (adult); *non* Oudemans 1911, Entom. Ber., 3, 123 (larva) and Oudemans 1912, Zool. Jahrb. Suppl., 14; Cooreman 1948, Explor. van. het Nat. Park Albert, Afl. 14, 18 (adult).

Tragardhula nilotica Womersley 1948, Tr. Roy. Soc. S. Austr., 72, (1).

Plate 84, fig. A–F.

Re-description of Adult (from specimen from India): Facies as in *Trombicula*. Colour in life whitish (after Berlese). Length to 1,750μ, width to 1,050μ (after Berlese). Crista elongate, 260μ with subposterior sensillary area

about as long as wide, with paired short nude sensillae to 52μ long and their bases 52μ apart; epistome rounded, with fine denticulations and 1 ciliated seta. Eyes I on each side, very large, 72μ in diameter, and placed about midway along and well away from crista. Chelicerae with finely serrate inner (dorsal) edge. Palpi fairly stout; tibia with simple claw, and 3 accessory spines which are almost claw-like and placed about midway between base of claw and articulation of palpal tarsus; palpal tarsus elongate reaching beyond tip of claw. Legs shorter than body, I the longest, 1,650μ; tarsi I elongate and highest in distal half, 375μ long $\times$ 123μ high; metatarsi I 292μ long. Sternum entire, much wider than long; precoxal plates of leg I not evident. Dorsal setae 30–40μ, uniform, fairly and uniformly thick to tip, with short ciliations. Genital discs 3 pairs.

Loc. and Remarks. This species which is the genotype, was originally described from specimens found on the leaves of an aquatic plant, *Pistia,* on the White Nile. It was associated with a larval Trombidiid which was thought to be its larva, but which is now regarded as not belonging to the same species, or even to the Trombiculidae. Womersley (1948) has recently discussed this question and suggested that the true larvae of *Tragardhula nilotica* may ultimately be shown to be *Tragardhula* (*Pentagonella*) *ardeae* (Trag. 1904), which agrees generically in the larvae, and which is the type of Sig Thor's *Pentagonella.* It was found on the legs of a heron from the same habitat and locality.

Tragardhula nilotica also occurs in India in the same habitat and I am informed by Dr. J. Cooreman of the Musée Royale Belgique, that he also has material from a similar habitat in the Belgian Congo, strangely enough also associated with larvae similar to those with which it was associated in Egypt. In a recent publication (1948), Dr. J. Cooreman has recorded this material, which included adults, nymphochrysalides and larvae. Both adults and larvae agree with Tragardh's material (I was personally priviliged to see these while in Brussels in 1947) but no details of the nymphochrysalis are given by Cooreman. He considers that, the larvae and adults being found together in a precisely similar biotype to Tragardh's specimens, the larvae and adults must be associated. With this conclusion, as pointed out above, one must disagree.

TRAGARDHULA ACUSCUTELLARIS (Walch 1922).

Trombicula acuscutellaris Walch 1922, Kitasato Archiv. Exper. Med., 5, (3), 78; Gater B. A. R., 1932, Parasitology, 24, 143–174; Mehta D. A., 1937, Ind. J. Med. Res., 25, (2), 353–365; Philip, Woodward and Sullivan 1946, Amer. J. Trop. Med., 26, (2); Radford C. D. 1946, Parasitology, 37, (1–2); Jayewickreme S. H., 1947, Nature, 160, 578.

Trombicula (Pentagonella) acuscutellaris, Sig Thor 1936, Zool. Anz., 114, 30; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 78.

Tragardhula acuscutellaris, Sig Thor and Willman 1947, Das Tierreich, Lfg. 71b, 296; Womersley 1948, Tr. Roy. Soc. S. Austr., 72, (1).

Plate 84, fig. G–N.

Re-description of Nymph (after Womersley 1948). Colour in life bright red. Of typical *Trombicula* facies. Length to 800μ, width across hysterosoma 400μ. Crista linear with somewhat diamond-shaped sensillary area and two nude filamentous sensillae, 136μ long, bases 42μ apart. Eyes 1 + 1, well removed from sensillary area and about half-way between extremes of crista. Chelicerae normal with fine inner serrations. Palpi with tibial claw strong, with 2 accessory spines but these on a slight boss and placed about midway between base of claw and articulation of palpal tarsus. Palpal tarsus slightly clavate, not reaching tip of claw. Legs shorter than body, I 660μ long, II 460μ, III 470μ, IV 530μ; tarsus I less than twice as long as wide, 151μ by 91μ, metatarsus I 115μ long. Dorsal setae numerous, 40μ long, uniform, arising from closely set tubercles, uniformly thick with strong ciliations. Genital discs 2 pairs.

Description of Adult (after Womersley 1948). No apparent difference in size of males and females. Colour in life deep red. Of typical *Trombicula* facies. Length 1,800μ, width across hysterosoma 1,200μ. Crista linear with well developed sensillary area, roughly diamond-shaped, with the sensillae bases at the end of transverse dumb-bell shaped areola; crista 300μ long; sensillae bases 65μ apart, and sensillae 195μ long, filamentous and nude. Epistome well developed, rounded-conical with numerous teeth and a single seta 71μ long. Eyes 1 + 1, large, well away from crista and midway of crista length. Chelicerae with finely toothed inner edge. Palpi with strong tibial claw and 3 accessory spines which are distinctly away from base of claw, and another on outer edge opposite articulation of tarsus, and on the outer surface another strong spine. Legs normal, I 1,275μ long, II 910μ, III 910μ IV 1,235μ; tarsi I 325μ long by 163μ high, metatarsi I 247μ long. Sternal shield between epimera of legs I and II, markedly shorter than wide. Genital orifice situated close in to epimera of legs III and IV, with 3 pairs of discs; in the male provided with a penis as figured, the apical point of which is asymmetrical. Dorsal setae numerous, uniformly thick, with short ciliations, to 40μ.

Remarks. The nymphal description is from a specimen reared by C. D. Radford from larvae from the Maldive Islands, and that of the adult from captured specimens from S. H. Jayewickreme from Ceylon (see Womersley, 1948). The adults and nymphs can be separated from other known species as in the key.

TRAGARDHULA JAPONICA (Tanaka 1916).

Leptus autumnalis japonica Tanaka 1916, Igakkai Zasshi (in Jap.), 30, (22); 1918 Ikai Jiho (in Jap.), No. 1,228.

Trombicula autumnalis japonica (Tanaka *et al.* 1930), Zentrblt. Bakt., 116, (1), 361; Sig Thor and Willmann, 1947, Das Tierreich, Lfg. 71b.

Trombicula japonica, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 79.

Tragardhula japonica Womersley 1948, Tr. Roy. Soc. S. Austr., 72, (1).

Tanaka (1930) appears to have been the only worker so far to have reared and described the nymph of this species. The adult is still unknown. That it must be placed in *Tragardhula* is evident from Tanaka's description of the eyes, and from his photograph (Pl. IV, fig. au). In the presence of eyes in the nymph it is not to be confused with the European *autumnalis* Shaw as was done by Tanaka, and still more recently by Sig Thor and Willmann 1947. The following description is drawn up from details given in Tanaka's paper of 1930.

Nymph. Of typical *Trombicula* facies. Length 495μ to 790μ, width 248μ to 389μ. Colour in life bright red, crista linear with subposterior sensillary area, and paired filamentous sensillae similar to those of larvae. Eyes 1 + 1, well away from crista and well in front of sensillary area. Palpi fairly stout, tibia ending in strong claw (accessory spines not mentioned by Tanaka, but doubtless two and placed as in other species of *Tragardhula*); tarsus oval three times as long as wide. Chelicerae serrated on inner (dorsal) edge. Legs all shorter than body; length (excluding coxae) I 664μ, II 394μ, III 402μ, IV 459μ; tarsi I slightly more than three times as long as high, 193μ by 61·5μ long, metatarsi I 123μ long (those in a specimen 796μ long). Dorsal setae pointed and ciliated, longer posteriorly, ? to 58μ. Genitalia with 2 pairs of discs, the anterior pair oval and larger than the round posterior pair.

TRAGARDHULA PERUVIANA (Ewing 1926).

Trombicula peruviana Ewing 1926, Ent. News, 37, 112; Ewing 1931, Proc. U.S. Nat. Mus., 80, (8), 9; Ewing 1933, Proc. U.S. Nat. Mus., 82, (29), 2.

Trombicula (Megatrombicula) peruviana, Michener 1946, Ann. Entom. Soc. Amer., 39, 434.

Tragardhula peruviana, Womersley 1948, Tr. Roy. Soc. S. Austr., 72, (1).

This species is as yet, only known from a single adult in the U.S. Nat. Mus., from El Campaniento, Peru. The description as given by Ewing (1926) is as follows:

"Colour of preserved specimens a light brownish orange. Palpi slender, reaching to about the tips of first femora; palpal thumb slender, not swollen, and slightly surpassing the palpal claw; penultimate segment very slender and bearing at its free end the rather small palpal claw which is slightly over one-half as long as the segment bearing it. In addition to the palpal claw, the penultimate segment bears on its inside a comb of three long, approximate spines, the middle of which is longer than the other two. Eyes projecting, with strongly curved corneas and situated far in front of pseudostigmatic area. Pseudostigmatic area large, posterior lobes oval, approximate to medial line; pseudostigmatic organs, very slender, flagelliform, and with a few pectinations. Setae of body very long, especially on the shoulders and posterior margin; barbed conspicuously for about two-thirds their length, but the tips almost bare. First pair of legs much longer than the others; tarsus I slightly swollen, almost straight and about one-fourth longer than tibia I; tibia I clearly longer than patella I; patella I and femur I subequal. Tarsus II and tarsus III about one and one-fourth times longer than tibia II and tibia III respectively. Tarsus IV not swollen, considerably longer than tibia IV, and tibia IV considerably longer than patella IV. Length 2·5 mm.; width 1·5 mm."

TRAGARDHULA ALLEEI (Ewing 1926).

Trombicula alleei Ewing 1926, Ent. News, 37, 111; Ewing 1931, Proc. U.S. Nat. Mus., 80, (8), 9; Ewing 1933, Proc. U.S. Nat. Mus., 82, (29), 2.

Trombicula (*Megatrombicula*) *alleei,* Michener 1946, Ann. Ent. Soc. Amer., 39, 434.

Tragardhula alleei, Womersley 1948, Tr. Roy. Soc. S. Austr., 72, (1).

Plate 85, fig. A–E.

This species was described originally (Ewing 1926) from a single specimen (holotype male; in collection U.S. Nat. Mus.) from Barro Colorado Island, Panama, Canal Zone. It was redescribed by Michener 1946 from adults collected at Juan Mina, Canal Zone, Panama. As well as being found in the usual type of terrestial habitat, specimens of adults were also recorded as being found on the floating leaves of *Pistia stratiotes,* a habitat similar to that for *Tragardhula nilotica* in Egypt and India, and also for *Tragardhula attenuata* Michener from Panama.

Adults and nymphs were also reared by Michener from larvae.

Description of Adult (after Michener 1946). Brilliant red in life. Length 1·5 to 2·5 mm. Crista rod-like, expanded gradually to the rear in to the triangular pseudostigmatic area, which bears the simple (and about as long

as the crista) pseudostigmata at its posterior lateral angles. Palpal tibia with claw, measured along upper margin, 0·30 to 0·36 times its length; inner surface of tibia with 3 spines arising from a small projection and a fourth much nearer base; tarsus reaching tip of claw, slender, with 4 or 5 small bristles at apex and mostly simple setae. Eyes 1 + 1, large, away from crista and in front of pseudostigmatic area. Legs shorter than body; tarsus I swollen, highest near middle, less than 3 times and sometimes only a little more than twice as long as high, 1·30 to 1·38 times as long as preceding segment. Dorsal setae from 70 to 160μ long, ciliated.

Description of Nymph (after Michener 1946). Length freshly emerged 1·0 to 1·2 mm. Palpal tibia with only 2 accessory spines (? sometimes only one). Dorsal setae sparser than in adult, 50 to 70μ long. Tarsus I 1·4 to 1·5 times as long as preceding segment. Otherwise similar to adult except for nymphal characteristics.

Bionomics. Michener has made some very interesting observations on the habitat and life-history of this species. Adults were found at all seasons in wet leaf mould close to the shore of the Chagres River, under aquatic vegetation left stranded, and on floating plants of *Pistia stratiotes.* Specimens from the last habitat were smaller, and more numerous. The eggs were laid singly or in twos, threes or fours on leaves of *Pistia,* but in rearing some thirty larvae emerged at the same time, so it is probable that greater numbers were laid. This is in agreement with the fact that the female of *Tragardhula nilotica* from India studied by the present writer, contain some 12–15 eggs ready for laying. In the species of *Trombicula* s. str. the eggs appear to be laid singly, and rarely does one find more than 1 or 2 eggs in the gravid females.

Remarks. An adult specimen from Juan Mina, kindly sent to me by Dr. Michener, has the following dimensions: Crista as figured by Michener, 390μ long, with sensillae 240μ long, nude; sensillae bases 84μ apart. The epistome is rounded conical with small denticles laterally, epistomal seta fine, sparsely ciliated, 110μ long. Tarsi of leg I 375μ by 143μ, metatarsi 273μ. Dorsal setae posteriorly to 84μ. Eyes smaller than in *velascoi,* 32μ in diameter. The sternum is well defined, wider than long; no precoxal plates on leg I.

TRAGARDHULA VELASCOI (Boshell and Kerr 1942).

Trombicula velascoi Boshell and Kerr 1942, Rev. Acad. Columbiana Cien. Exact. Fisic. Nat., 5, 113.

Trombicula (*Megatrombicula*) *velascoi* Michener 1946, Ann. Entom. Soc. Amer., 39, 438.

Tragardhula velascoi Womersley 1948, Tr. Roy. Soc. S. Austr., 72, (1), 89.

Plate 85, fig. I–N.

Originally described from Restrepo, Intendencia de Meta, Columbia (type locality), and also from Villa Vicencio, and the Municipo of Bolivar, Columbia, this species was re-described by Michener from material from Juan Mina and Chiva Chiva, Canal Zone, Panama, and from Old Panama and Santa Rosa, Panama.

Both adults and nymphs were collected in nearly every month of the year under stones and logs and in leaf mould, but frequently in relatively dry situations in contrast to other species.

The descriptions of the adult and nymph (after Michener) are as follow:

"*Adult.* Length 1·6 to 2·5 mm. Brilliant red in life. Claw of pedipalp measured along upper margin 0·30 to 0·36 times length of pedipalpal tibia; inner surface of tibia with eight to seventeen spines (average of twenty-five specimens 12·1) arranged around lateral and apical margins, those nearest apex consistently present, those nearer base of segment frequently absent, so that the row of spines is sometimes broken by large gaps; sometimes there are one or two spines arising near middle of segment, not in marginal row; finger of pedipalp with five to seven short simple bristles apically, other hairs mostly barbed or plumose. Crista and pseudostigmatic organs similar to those of *alleei*. Body hairs about two-thirds as long on shoulders as on posterior end of body, plumose but the setulae smaller towards apices of hairs and sometimes absent from extreme apices; longest body hairs 0·15 to 0·20 mm. in length. Legs shorter than body, or first pair as long as body, robust; last tarsal segment of anterior legs somewhat swollen, broadest near middle, slightly less than three times to over four times as long as broad, 1·49 to 1·61 times as long as preceding segment and ordinarily broader than that segment.

Nymph. Length (when freshly emerged) 0·9 to 1·0 mm. Older nymphs reach 1·5 mm. Similar to adult except for usual nymphal characteristics. Claw of pedipalp sometimes nearly half as long as tibia, which bears three to eight spines on inner surface. Body hairs sparser than in adult, those of posterior end of body two or three times as long as those of shoulders; longest hairs 0·09 to 0·14 mm. in length. Legs similar to adult, last segment of foreleg 1·50 to 1·60 (or in one specimen, perhaps abnormal, 1·75) times length of preceding segment."

Bionomics. The larvae have been reared from captured females (see Larval Section of this paper) and described by Michener 1946.

Remarks. I am indebted to Dr. Michener of the Amer. Mus. Nat. Hist., New York for an adult of this species, from which the crista and coxae I and II with sternum are figured and the following measurements made. Crista 360μ

long, with subposterior sensillary area and sensillae long, 260μ, filamentous and nude with bases 78μ apart; epistome rounded-conical, 84μ long by 78μ wide at base, margin scarcely dentate, seta long and slender, lightly ciliated, 110μ long. Eyes large, to 60μ in diameter and situated away from crista and in front of sensillary area. Palpi with simple tibial claw; tibia with 3 strong accessory spines on inner tubercle. (Boshell and Kerr show 7–8 spines in the form of a pectine, and Michener states that in a number of specimens they vary considerably from 8 to 17 with an average of 12; thus the specimen examined seems to be an extreme form. The other spines have not been knocked off, for bases cannot be seen). The tarsus with 5–6 apical spines. Tarsi of leg I are not quite as long in proportion to height as shown by Michener, and measure 365μ long by 190μ high, while metatarsi I are 250μ long. The dorsal setae are somewhat longer anteriorly than posteriorly, to 78μ and to 65μ respectively. The setae on the legs are much more slender and tapering, less strongly ciliated and measure to 130–150μ long. The sternum is well defined, entirely enclosed, wider than long, and without a longitudinal division, i.e. precoxal plates of coxae I are absent or have combined to form the sternum.

Despite the differences between this specimen and Michener's description I have no doubt that it is the same species.

TRAGARDHULA ATTENUATA (Michener 1946).

Trombicula (*Megatrombicula*) *attenuata* Michener 1946, Ann. Ent. Soc. Amer., 39, 440.

Tragardhula attenuata, Womersley 1948, Trans. Roy. Soc. S. Austr., 72, (1).

The description of the adult of this species as given by Michener 1946 is as follows:

Plate 85, fig. F–H.

"*Adult.* Length 2·0 mm. (varying from 1·4 to 2·1 mm. among paratypes). Brilliant red in life. Claw of pedipalp measured along upper margin about 0·20 (varying from 0·19 to 0·23) times length of pedipalpal tibia, which is extraordinarily slender; inner surface of tibia with three blunt spines arising near (or basad of) middle of upper margin; finger of pedipalp with four or five short simple bristles apically, other hairs mostly simple. Crista about as in other species; pseudostigmatic organs simple, longer than crista. Body hairs but little longer at posterior end of body than on shoulders, plumose throughout length; longest body hairs 0·13 mm. (longest hairs varying among paratypes from 0·05 to 0·13 mm.) long. Legs slender, anterior pair

longer than body, others shorter; last tarsal segment of anterior legs not swollen, not thicker than preceding segment, about parallel sided (sometimes slightly thicker beyond middle or subapically than elsewhere), four and one-half (varying from four to over four and one-half) times as long as broad, 1·20 (1·19 to 1·25) times as long as preceding segment."

Bionomics. Michener found this species only on floating plants of *Pistia stratiotes* on the Rio Hondo, along with two other species of Microtrombidiinae. They were found among the coarse hairs and ribs of the under-side of the leaves. The eggs were laid in masses of twenty-five to fifty on the under surface of the leaves. The larvae are only known from reared specimens, and their hosts are unknown.

Genus IPOTROMBICULA nov.

With the general facies of *Trombicula,* constricted between second and third pairs of legs. Crista flask-shaped, without an areola within the subposterior sensillary area; a long ciliated seta, at the base of the rod of the crista just anterior of the sensillary area; epistome transverse, with straight front margin, denticulate, with one ciliated seta. Sensillae filamentous and nude. Eyes one on each side, large, closely adjacent to sensillary area. Palpi slender, tibia with simple claw and in adult, 3 accessory spines at base. Front tarsi clavate, with the greatest depth (height) distad of middle.

Genotype *Trombicula elegans* Womersley 1942.

IPOTROMBICULA ELEGANS (Womersley 1942).

Trombicula elegans Womersley 1942, Rec. S. Aust. Mus., 7, (2), 173, fig. 4 A–I.

Plate 86, fig. A–E.

Re-description of Adult. Very elongate species but with constriction between second and third pairs of legs. Length 1·67 mm., width of both propodosoma and hysterosoma 0·58 mm.; hysterosoma about twice the length of propodosoma. Colour in spirit white. Crista 167μ long, linear, with a subposterior flask-shaped sensillary area without any dumb-bell shaped areola; with paired, nude, filamentous sensillae 96μ long, and their bases 42μ apart; in front of the sensillary area and on the rod of the crista is a ciliated seta 60μ long; epistome transverse with straight front margin with fine denticulations and one ciliated seta 54μ long. Eyes large, one on each side and closely adjacent to sensillary area. Chelicerae with inner (dorsal) margin finely serrated. Palpi slender; tibia with a strong simple, apical claw and 3 strong accessory spines at its base; tarsus somewhat clavate and reaching tip of tibial

claw. Legs relatively short, I 1,000μ long, II 665μ, III 650μ, IV 900μ; tarsus I clavate with the widest part distad of the middle, 245μ long by 102μ high (remeasured); metatarsus I 212μ long. No distinct sternum, i.e. space between anterior pairs of coxae not closed posteriorly, no precoxal plates on leg I. Dorsal setae numerous, fine and slender, tapering with fine ciliations, 35μ anteriorly increasing gradually to 80μ posteriorly. Genital aperture with 3 pairs of discs.

Locality. This species was described from two females from Lush Island, South Australia, collected December, 1936 by the McCoy Expeditoin, from just about high water mark. No fresh material has come to hand.

Genus SPEOTROMBICULA Ewing 1946.

J. Parasitology, 1946, 32, (5), 437. Genotype *Trombicula trifurca* Ewing, 1933, Proc. U.S. Nat. Mus., 82, (29), 1–6.

This genus is so far only represented by the genotype. The generic diagnosis as given by Ewing 1946 is as follows:

"*Adult stage.* Palpi slender, slightly curved; palpal claw acute at apex, with a single accessory spine near base; palpal patella not emarginate ventrally. Epistome a poorly sclerotized band-like comb. One rostral seta present. Eyes absent. Crista broad, plate-like; pseudostigmata small, far apart; pseudostigmatic organs minute, setiform. Abdomen slightly constricted in front of middle. Dorsal abdominal setae barbed, of one kind, longest on posterior margin. Genital opening large, with 3 pairs of genital suckers. Coxae I with a shelf-like expansion along its anterior margin. Coxae I and II united. Anterior legs much longer, and stronger than others and each ending in a pair of subequal, curved, distally trifurcate claws. Legs II, III and IV nearly equal and each ending in a pair of large, strongly curved, simple claws."

SPEOTROMBICULA TRIFURCA (Ewing 1933).

Trombicula trifurca Ewing 1933, Proc. U.S. Nat. Mus., 82, (29).

Speotrombicula trifurca Ewing 1946, J. Parasitology, 32, (5), 437.

Plate 86, fig. F–H.

Ewing's description of this species is as follows:

"*Adult.* Slender, with anterior pair of legs, mouth parts, and anterior part of cephalothorax darker and more sclerotized than the other parts. Mouth parts situated on a more or less distinct capitulum, which has parallel sides and is terminated below in a large trowel-shaped hypostome. Palpi slender, extend-

ing to about the middle of first patellae; palpal claw weak, slightly curved, about two-thirds as long as segment which bears it; palpal thumb very slightly swollen, reaching base of palpal claw; only one accessory spine present which is about one-half as broad as palpal claw. Chelicerae very long and slender, basal segment about four-fifths as long as capitulum; chela slender, with a sharp upper edge. Crista broad, plate-like with pseudostigmatic area reduced and near the posterior end; pseudostigmata small, circular, and far apart; pseudostigmatic organs apparently absent. Eyes absent. Abdomen fully twice as long as broad and with the usual constriction at the level of third and fourth coxae; setae longest around posterior margin. Genital opening large; situated about half its diameter from fourth pair of coxae; genital suckers six, first pair slightly larger than the others. Anal opening about half as broad and two-thirds as long as genital opening and situated about its greatest diameter from the latter. Coxae of first two pairs of legs united to a sternum and those of first pair each expanded along its anterior margin into a shelf-like lamella. Anterior pair of legs much larger and longer than the others and each ending in a pair of trifurcate claws. Legs II and III rather weak, subequal; legs IV considerably stouter and longer; claws of legs II, III and IV simple but inflated towards the tips. Length 2·7 mm.; width 0·9 mm."

Remarks. The species was described from four adults from Chilibrilla Caves, Panama, and Ewing suggests that its larvae will probably be found to parasitize bats. In his specific description he states that the pseudostigmatic organs are "apparently absent", but in his generic description says "minute, setiform." The sternum according to his figure is entire, and no precoxal plates of leg I are evident. The epistome and epistomal (rostral) seta were not described until his generic revision of the species in 1946. In this paper he describes the epistome as . . . "a poorly sclerotized band-like comb." He also states . . . . "one rostral seta present." In his fig. 1, the outlines of the epistome are not delineated except the denticulate anterior margin which is straight. The rostral (epistomal) seta is shown as having only one short branch.

Genus TROMBICULA Berlese 1905.

Acari nuovi, Manip. IV, 155, t. XV, fig. 4 in "Redia", 1, (2), 1905; *idem*, 1912, "Redia", 8, (1), 94, fig. 44 A–C.

Genotype *Trombicula minor* Berl. 1905.

= *Eutrombicula* Ewing s. str. 1938, J. Washington Acad. Sci., 27, 288–295.

With our increased knowledge of the adult species of the Trombiculidae, and the correlation of adults and/or nymphs with their larvae it is possible to

define the genus *Trombicula* in its non-parasitic stages with more precision as in the following diagnosis.

"Adults and nymphs of a characteristic figure of 8 shape, with a pronounced median constriction, and the propodosoma usually narrower than the hysterosoma. Crista linear, rod-like, ending anteriorly in a hyaline, transverse or conical denticulate epistome with a single seta, and posteriorly with a more or less diamond-shaped sensillary area, with an internal areola from which arise a pair of filamentose sensillae. Eyes present, or absent, when present then one on each side and placed closely adjacent to the sensillary area. Palpal tibia with a single claw, and 3 accessory spines at the base of claw, with a single strong spine about midway between base of claw and articulation of palpal tarsus (in the nymphs with only 2 accessory spines at base of claw); rarely with a pectine of spines on palpal tibia. Tarsi I tapering with the greatest width (height) basad of middle. Sternum usually entire, no precoxal plates present (in subgen. *Leptotrombidium* precoxal plates present on leg I forming a longitudinally subdivided sternum). Genitalia with 3 pairs of discs in adult, 2 pairs in nymphs."

The specific characters in this genus are somewhat intangible, consisting mainly of the proportions in the length and height of the tarsi of leg I, and the length of the dorsal setae.

The genus can, however, be separated into three subgenera, *Trombicula* s. str. 1905, *Leptotrombidium* Nagayo *et al.* 1916, and *Neotrombicula* Hirst 1915, based on the presence or absence of eyes, and the presence or absence of precoxal plates on leg I, as given in the following key.

Key to the Subgenera of TROMBICULA Berl. 1905.

1. Eyes present. No precoxal plates on leg I or these fused completely to form an undivided sternum.

   Subgen. *Trombicula* Berl. s. str. 1905.

   Eyes absent 2

2. Precoxal plates well developed on leg I and forming a longitudinally divided sternum.

   Subgen. *Leptotrombidium* Nagayo *et al.* 1916
   (type *Trombicula akamushi* Brumpt 1910).

   No precoxal plates on leg I or these completely fused to form an undivided sternum.

   Subgen. *Neotrombicula* Hirst 1915.
   (type *Acarus autumnalis* Shaw 1790).

Subgen. TROMBICULA Berl. s. str. 1905.

Key to the Known Adult and/or Nymphal Species.

1. Old World species 2
   New World species 5
2. Size small, approximately 680μ or less 3
   Size larger, 1,000μ or smaller 4
3. Eyes very large, almost as wide as sensillary area. Dorsal setae uniform in length, 20–25μ, tapering with moderately long setules. Tarsi I, 100μ long by 40μ high; metatarsi I, 90μ long, not higher than tarsi I. *Trombicula* (*T.*) *minor* Berlese 1905 (Adult).

   Eyes smaller, not much wider than the basal cup or ring of the sensillae. Dorsal setae 14μ anteriorly to 20μ posteriorly with long strong setules. Tarsi I 72·8μ long by 28·0μ high; metatarsi I 61·6μ long, and higher than tarsi I. *Trombicula* (*T.*) *frittsi* Wharton 1945.
4. Dorsal setae to 40μ, tapering with moderately long setules decreasing towards the tip. Tarsi I 2·4 times as long as high, and one and a half times as long as metatarsi. *Trombicula* (*T.*) *samboni* Womersley 1936

   Dorsal setae 25 to 55μ long, uniformly thick with setules equally long to tip. Tarsi I twice to two and a half times as long as high, and half as long again as metatarsi.
   Trombicula (*T.*) *wichmanni* (Ouds. 1905).
5. Dorsal setae uniform in length, 36–40μ. Tarsi I 1·41 to 1·49 times as long as metatarsi; 1·76 times as long as high, 1·25 times as long as metatarsi. *Trombicula* (*T.*) *batatas* (Linn. 1758).

   Dorsal setae not uniform, increasing in length posteriorly 6
6. Dorsal setae posteriorly to 110μ. Tarsi I 2·8 times as long as high, 1·25 times as long as metatarsi. *Trombicula* (*T.*) *helleri* Ouds. 1911.

   Dorsal setae shorter posteriorly 7
7. Dorsal setae posteriorly to 75μ, apically in lateral view with an indistinct spathulation showing dorsally as a small hyaline blob. Palpal tarsus with 9–11 nude apical setae. SB 55–70μ.
   Trombicula (*T.*) *splendens* Ewing 1913.
   = *masoni* Ewing 1943.

   Dorsal setae shorter posteriorly and without apical spathulation or blob 8
8. Posterior dorsal setae to 45μ long. Ratio length to height of tarsi I = 2·1–2·6 : 1·0 *Trombicula* (*T.*) *vanommereni* Schierbeck 1937.

   Posterior dorsal setae longer 9
9. Tarsi I only slightly more than twice as long as high, 2·05–2·11. SB 48·0–51·0μ. Palpal tarsus with 7–8 apical nude setae. Dorsal setae posteriorly to 56μ. *Trombicula* (*T.*) *alfreddugesii* (Ouds. 1911).

   Tarsi I rather more than 2½ times as long as high, 2·59. SB 61·6μ apart. Palpal tarsus with 7–8 nude apical setae. Dorsal setae posteriorly to 56μ long. *Trombicula* (*T.*) *jacoti* nom. nov.

TROMBICULA (TROMBICULA) MINOR Berlese 1905.

Trombicula minor Berlese 1905, Acari nuovi, Manip. IV, 155, t. XV, fig. 4 in "Redia," 2, (2); *idem* 1912, "Redia," 8, (1), 94; Ewing 1920, Ann. Ent. Soc. Amer., 13, 385–389; *idem* 1938, J. Washington Acad. Sci. 28, 292; *idem* 1944, U.S. Naval Med. Bull., 43, (4), 837–839; ? *non* Gunther 1939, Proc. Linn. Soc. New South Wales, 64, 285–286; ? *non* Womersley and Heaslip 1943, Tr. Roy. S. Austr., 67, (1), 92; Willmann 1941, Zool. Anz., 133, 131–136, Sig Thor and Willmann 1947, aDs Tierreich, Lfg. 71b, 347.

Plate 87, fig. A–C.

Berlese described this species, the genotype, from two specimens from Tjompea, Java. In his original description he figures an entire dorsal view and a dorsal seta. Later 1912, in his monograph he added figures of the front tarsus and metatarsus, and of the palp, as well as an enlarged figure of the palpal tibia and tarsus. In the later work he stated that the types were in the Hamburg Museum, but that he had retained fragments of one specimen from which his later figures were derived. He further stated that he did not possess the base of the cephalothorax with the sensillary area and could not therefore confirm the presence or absence of eyes. Because Berlese's figure of the palpal tibia shows only two accessory spines at the base of the claw, it has been generally assumed by acarologists that his specimens were nymphs. In 1941, however, Carl Willmann published his study of the types in the Hamburg Museum, and showed that the two specimens were adult females, having 3 accessory spines at the base of the palpal claw, and one specimen having an egg enclosed, and both having the 3 pairs of genital discs.

The types were labelled "Tjompea, Java, 19, III, 1904, aus Hohlenguano gesiebt", this habit not having been mentioned by Berlese.

Willmann gave a figure of the sensillary area and base of the crista. The sensillary area is shown as hexagonal with the sensillae bases placed on the lateral walls of the area. Around the sensillae bases is to be seen a clearly defined circular line, with a diameter of about half the width of the sensillary area. The inner third of this circular line is obscured by the area wall. Ewing 1944, in discussing Willmann's paper regards these circles as the outer rim of the very large sensillae bases, not as eyes. Willmann himself, however, appears to be uncertain as to whether they are eyes or not. To my mind they are definitely eyes, or at least the rims of the lobes of the sensillary area, such as in Berlese's figure for *mediocris*, but with the corneas not shown. Ewing's idea that they represent very large sensillary bases is not justified. The sensillae

bases in the Trombiculidae are a part of the sensillary area, and the position as shown by Willmann indicates displacement in the preparation. This also would account for the somewhat unusual position of the eyes partly beneath the wall of the sensillary area. The sensillae are only shown in their basal portion, but with distinctly short barbs.

In general, the figure given by Willmann agrees with that of Berlese 1905, in which, under a lens, the large circles representing the eyes can be seen; it also is closely suggestive of that of *mediocris* and the two forms may ultimately be found to be the same.

Ewing in discussing Willmann's paper concluded as follows:

"1. *Trombicula minor* Berl. is a very small species; the adults of which are about the same size as the nymphs of *Trombicula akamushi* (Brumpt) and *Trombicula deliensis* Walch.

2. The species is peculiar in that the pseudostigmata are very large, the palpal claw is but slightly tapering and the subterminal spines of the palpal tibia are almost setiform, long, set adjacent to each other and subparallel.

3. Being found in cave guano, the inference is strong, that the larvae of *T. minor* have bats as hosts.

4. Because of these facts it appears to the writer that *Trombicula hirsti* Sambon is a species distinct from *T. minor* Berlese."

With these conclusions the present writer is generally in accord, except in considering that the so-called large sensillae bases of Ewing are really the eyes, as discussed above.

By Willmann's valuable re-examination of Berlese's types there seems reasonable ground, for the present at any rate, for regarding *T. minor* Berlese as different from *T. wichmanni* Ouds. (= *mediocris* Berl., = *hirsti* Sambon). The most important differences are the smaller size, shorter and more uniform dorsal setae, size and dimensions of front tarsi, and possibly in the structure of the sensillary area and eyes.

For the present it also follows that the true larvae of *T. minor* are unknown although several species of bat-infesting Trombiculids are known from the Asiatic-Pacific area. However, until more material, both larvae and adults, are obtained from the type locality, or adults and larvae correlated by rearing, none of these known larvae can be assumed to belong to *T. minor* Berlese.

Re-description of Adult (after Willmann 1941). Colour whitish. Body elongate, strongly constricted medially. Crista long and straight (127μ), in the middle with a longitudinal furrow, widened behind to a 6-angled sensillary

area. The pseudostigmata lie directly on the outer edges of the areola. From them arises the long, stiff, finely ciliated sensillae. These are 107μ long. The pseudostigmata are outwardly surrounded by a strongly developed smooth ring, almost two-thirds round, resembling a (rudimentary) eye; the sensillae bases lie eccentrically in the ring, and are half under the areola and half under the eye-like ring. Palpal tibia with strong claw and on inner edge with 3 thick, closely adjacent strong spines (not 2 spines as given by Berlese). Cuticle with short, ciliated setae arising from small papillae. Leg I long and strong. Tarsus I 100μ long by 40μ high, metatarsus I 90μ long. Length of animal 680μ.

TROMBICULA (TROMBICULA) FRITTSI Wharton 1945.

Trombicula frittsi Wharton, 1945, J. Parasitology, 31, 4, 282–283 (larvae).

Plate 87, fig. D–G.

Description of Nymph. Of typical *Trombicula* facies, but rather elongate. Length (unfed) to 325μ; width across propodosoma 150μ, across hysterosoma 162μ. Crista linear with subposterior sensillary area, length 75·6μ, SB 25·2μ, sensillae 70μ long, slightly thickening soon after the base and basally finely barbed but in distal three-fourths with long outstanding setules. Epistome dentate, with one ciliated seta 22μ long. Chelicerae finely serrate on inner (dorsal) edge. Palpi rather elongate, with two accessory spines at base of claw. Eyes present but difficult to see, one on each side and closely adjacent to sensillary area. Dorsal and ventral setae rather sparse, dorsally anteriorly 14μ lengthening to 20μ posteriorly, pointed with outstanding setules. Legs: I as long as body, thicker and stronger than rest, to 325μ long, II 195μ, III 182μ, IV 225μ; tarsi I tapering and slightly shorter than or equal to metatarsi, which is wider, 72·8μ long by 28·0 high; metatarsi I 64·4μ long by 30·8μ high. Genital organ with paired discs.

Loc. Described from the type nymph and 10 paratypes reared by K. L. Cockings from engorged larvae from scorpions, *Heterometrus longimanus* from Kukit Lagong Forest Reserve, Kepong, Kuala Lumpur, F.M.S. The larvae were all collected on 21 Sept., 1949, and the nymphs emerged and were mounted on the 10th and 14th Oct., 1949.

Remarks. The presence of distinct eyes, although these are not easily seen, places this species in the genus *Trombicula* s. str. Although as yet only known from the nymph in its small size, it is closely related to *Trombicula minor* Berl., and may even be the same. From Willmann's description and figures 1940, it appears to be distinct from Berlese's species, at least in the much smaller size of the eyes, and is thus separated in the key to the known species of nymphs and adults given here.

TROMBICULA (TROMBICULA) BATATAS (Linn. 1758).

Acarus batatas Linnaeus 1758, Gyst. Nat., 10th Ed. Genus 235, Species 22.

Eutrombicula batatas, Michener 1945, Ann. Rept. Gorgas Labor., U.S. Gov. House Document, No. 396, p. 22; 1946, *idem,* U.S. Gov. House Document No. 12, p. 13; 1946, Ann. Entom. Soc. America, 39, (1), 101–118; *idem* 1946, *ibid.* 415.

For further synonymy see Larval Section.

Plate 87, fig. H–K.

This species has been reared through to all stages, and thoroughly described and figured by Michener 1946. I am indebted to him for a number of specimens of nymphs. The following description is summarized from Michener's studies:

Adult. Of typical *Trombicula* facies with hysterosoma wider than propodosoma. Colour in life red. Size ♀ 770 to 990μ; ♂ 660 to 830μ long. Crista slender; sensillary area broader than long with a transverse curved ridge in front of sensillae; sensillae filamentous, as long as crista, with a few short branches distally. Palpi slender; tibia with 3 accessory spines at base of claw and a fourth near middle of segment. Eyes one on each side, and adjacent to sensillary area. Legs shorter than body, I the longest; tarsi I 1·41 to 1·49 times as long as metatarsi. Dorsal setae short, 36–40μ long, with short ciliations.

Nymph. As in adult, but smaller and with the usual nymphal differences in accessory spines at base of claw being only two and in having only 2 pairs instead of 3 pairs of genital discs. Length 500 to 550μ.

Remarks. From the several specimens of nymphs of this species received from Dr. Michener the following data was obtained:

Crista 162μ long; sensillae 154μ, with bases 39μ apart. Epistome and epistomal setae not observed. Tarsi I 148μ long by 84μ high, metatarsi 118μ. Dorsal setae to 30μ long.

Bionomics. The larvae of this species is common on domestic fowls and many species of native birds in the Panama region as listed by Michener 1946.

TROMBICULA (TROMBICULA) HELLERI (Ouds. 1911).

Microtrombidium helleri Oudemans 1911, Ent. Ber., 30, 120; *idem* 1912, Zool. Jahrbr., Suppl., 14.

Eutrombicula helleri, Ewing 1938, J. Wash. Acad. Sci., 28, 294 (larvae); Michener 1946, Ann. Entom. Soc. Amer., 39, 411 (adult and nymph).

For other synonymy see Larval Section.

Plate 87, fig. L–N.

Michener 1946 has described the adult of this species from a single female from which larvae identified as Oudemans' species were obtained. The specimen was from leaf mould, at Santa Rosa, Colon Province, Panama, Sept. 10, 1945. The essential points of Michener's description are:

Of typical *Trombicula* facies. Colour red. Length to 1·3 mm. Palpal tibia with 3 accessory spines at base of claw (4 on one side) arising from a small elevation on inner side. Crista slender, 190μ long with broad subposterior sensillary area which is 47μ wide (measured to lateral margins). Eyes one on each side, adjacent postero-laterally to sensillary area. Legs shorter than body; I 900μ long; tarsi I 1·25 times as long as metatarsi and 2·8 times as long as high. Dorsal setae, ciliated, twice as long posteriorly as on shoulders, posteriorly to 110μ slender. Genitalia with 3 pairs of discs.

TROMBICULA (TROMBICULA) VANOMMERENI Schierbeck 1937.

Trombicula vanommereni Schierbeck 1937, Ann. Parasit. Hum. Comp., 15, 326.

Eutrombicula vanommereni, Michener 1946, Ann. Entom. Soc. Amer., 39, 413.

For further synonymy see Larval Section.

The nymphs and adults of this species are only known from specimens reared from larvae on lizards (*Ameiva praosignis*) from Panama, and described by Michener 1946. For other references to hosts of the larvae see Larval Section.

The following details are from Michener's paper:

Adult. Facies as in *T.* (*E.*) *batatas.* Colour red. Length 900μ to 1,100μ. Crista slender, 150 to 170μ long with broad subposterior sensillary area, 59 to 75μ wide (as between lateral margins). Sensillae about as long as crista with a few distal branches. Eyes large, half width of sensillary area. Palpal tibia with 3 accessory spines at base of claw arising from a slight protuberance, and a fourth at middle of segment. Legs all shorter than body; I 730μ; tarsi I 1·36 to 1·41 times as long as metatarsi and 2·1 to 2·6 times as long as high. Dorsal setae; those on shoulders about two-thirds as long as posteriorly, posteriorly 45 to 47μ long. Genitalia with 3 pairs of discs.

Nymph. As in adult but smaller and with nymphal characteristics. Tarsi I 1·7 to 2·2 times as long as high, and 1·39 to 1·53 times as long as metatarsi.

TROMBICULA (TROMBICULA) ALFREDDUGESII (Oudemans 1910).

Microtrombidium alfreddugesii Ouds. 1910, Ent. Ber. Nederl. Ver., 3, 84 (larvae). (For further synonymy of larvae see Larval Section.)

Trombicula cinnabarinus Ewing 1920, Ann. Ent. Soc. Amer., 13, 387, fig. 3.

Trombicula irritans, Ewing 1925, Proc. Biol. Soc. Washington, 38, 17–20; *idem* 1931, Proc. U.S.N. Mus., 80, (8), 8.

Eutrombicula alfreddugesii, Ewing 1944, J. Parasitology, 30, (6), 341.

Trombicula thalsahuate, Sig Thor and Willmann, 1947, Das Tierreich, Lfg. 71b, 345.

Plate 88, fig. A–F.

This species has been fairly well described and figured by Ewing under the name *cinnabarinus* and is very widely distributed in the United States of America (Ewing 1944). Ewing's description is as follows:

"*Adult.* Colour in live adults vermilion, or cinnabar. Cephalothorax triangular and with the crista extending from the anterior end of the latter as a straight ridge to about the middle of the triangular pseudosigmatic area. Posterior lobes of pseudostigmatic area evenly rounded and near the median line. Pseudostigmatic organs arising from pseudostigmata and provided with a few minute barbs on the posterior margins near their tips. Eyes well developed, very near the pseudostigmata and with thick and strongly curved corneas. Palpi armed with three tibial spurs; the longest of which is less than half as long as palpal claw; thumb of palpus not swollen and not surpassing the palpal claw. Chelicerae with lower chela sharp and provided with about two dozen backwardly directed teeth; upper chela represented by a chitinous tubercle-like knob. Abdomen clothed with the usual setae, which are but slightly, if at all, longer on the posterior border than on the shoulders, and have the barbs smaller at the somewhat tapering tip. Legs about as usual, the first pair being much the largest and longest. The tarsi of this pair are one and forty-seven hundredths times as long as the tibia. Posterior legs reaching to the tip of abdomen. Length of medium sized specimens, 0·92 mm.; width 0·52 mm."

In his 1944 paper, Ewing also figured and described the genital aperture and penis of the male.

Of this species I have been able to study the following specimens:

Two adults reared from larvae from *Neotoma micropus* Baird nests from Laguna Madre, Texas, Sept. 21st, 1945 (D. E. Hary and V. L. Wooley) and

kindly presented to me by Dr. G. H. Wharton. Also a number of specimens from amongst a collection of Trombidiids and Erythraeids sent to me by Dr. F. Bonet from Mexico. This last lot of material comprised nymphs and adults of both sexes. From this material the following data can be added to the description, and the figures accompanying this paper have been drawn.

Length of adults to 1,170μ; width across propodosoma 585μ, across hysterosoma 780μ. Crista (excluding epistome) to 195μ long. Epistomal seta 39μ long, and margin of epistome denticulate. Sensillae distally with a few branches, to 100μ long, and with the bases 58μ apart. Legs I to 845μ, II 520μ, III 455μ, IV 700μ; tarsi I 208μ long by 104μ high, metatarsi 156μ long. Dorsal setae to 45μ long, fairly thick and not much tapering, with numerous strong setules. In the male sex there are 4 apically spathulate and fimbriated "titillating" setae (not shown or observed by Ewing) on each side of the genital aperture and placed on a lobe and about midway between the second and third genital discs.

TROMBICULA (TROMBICULA) SPLENDENS Ewing 1913.

Trombicula splendens Ewing 1913, Bull. Amer. Mus., 32, 13–114, pl. 7, fig. 5; *idem* 1920, Ann. Ent. Soc. Amer., 13, 306, 389; *idem* 1926, Ent. News, 37, 111; *idem* 1932, Proc. U.S. Nat. Mus., 80, 10; Sig Thor and Willmann 1947, Das Tierreich, Lfg. 71b, 349; Jenkins 1949, J. Parasitology, 35, 201–4.

Acariscus masoni Ewing 1943, Proc. Ent. Soc. Wash., 45, 60.

Eutrombicula masoni (Ewing) Jenkins 1947, Ann. Ent. Soc. Amer., 40, 56–68.

Plate 88, fig. G–K.

Jenkins has recently discussed this species and established the synonymy of reared adults of *masoni* with *splendens* of Ewing.

A re-description of the adult, from 2 males and 2 females from culture No. 123, Duke University, N.C., 22 Dec. 1946 and kindly given to me by Dr. G. W. Wharton is as follows:

Adult. Colour in life red. Of typical *Trombicula* facies. Length to 1,500μ; width across propodosoma 850μ, across hysterosoma 990μ. Crista elongate, to 182μ long, with diamond-shaped sensillary area, and paired filamentous sensillae to 180μ long and finely ciliated or nude distally with their bases from 58·8 to 67·6μ apart (Jenkins gives 55–70μ); epistome not clearly visible but apparently rectangular with dentate margin; epistomal setae to 42μ. Eyes 1 + 1, closely adjacent to sensillary area. Chelicerae finely serrate on inner (dorsal) edge. Palpi stout; tibia with claw and

3 stout accessory spines at the base of claw; ventrally the tibia with a long nude spine-like seta; palpal tarsus with 9–11 nude apical setae. Dorsal setae fairly long, increasing from 30μ anteriorly to 75μ posteriorly, slender, strongly and long ciliated and at tip with a small and indistinct spathulation in lateral view and a hyaline blob in dorsal view. Legs I longer and stronger than the rest, to 990μ, II 640μ, III 710μ, IV 895μ; tarsi I from 214μ long by 117μ high, to 240μ by 136μ long (mean 230μ by 128μ, ratio 1·8:1·0); metatarsi I 149μ to 175μ long (mean 167μ, ratio length tarsi I to metatarsi I 1·37:1·0). Coxae I without precoxal plates. Male as in female, except for the genitalia but precise details were not sufficiently clear.

TROMBICULA (TROMBICULA) JACOTI nom. nov.

Trombiculoides scaber Jacot 1938, Psyche, 45, 121–132, *non Trombidium scabrum* Say, 1821, J. Acad. Nat. Sci. Philadelphia.

Plate 89, fig. A–D.

Ewing 1946, Proc. Biol. Soc. Washington, 59, 69, has discussed the status of *Trombiculoides* Jacot 1938, and clearly shown that the species which Jacot referred to Say's *scabrum* is not this species as recognized by other writers.

Howard (1918) reared the larvae and figured the species regarded as Say's *scabrum,* placing it in *Sericothrombium* Berlese. From Howard's figures and from Say's statement (1) that "the eyes are pedunculate and white" and (2) that "the body is ovate, broadest and very obtusely rounded before and with hardly perceptible hairs" it is certain that Jacot's specimens are not the same as Say's, a conclusion in which I am in full agreement with Ewing.

Jacot gives "from under the bark of a large prone oak, near Savannah, Georgia," as the locality for his specimens, and because some of the other species (but not *scabrum*) recorded by Say were from Georgia concludes that this was the type locality for *scabrum.* As pointed out by Ewing, however, Say merely states "in forests, on trees, etc. not uncommon" with no definite locality.

As Jacot's identification of his specimens with *scabrum* is therefore incorrect, his generic name *Trombiculoides* becomes a synonym of *Sericothrombium* Berlese. The specimens of Jacot are typical *Trombicula* as recognized in the present work, and a new specific name being required, that of *jacoti* is proposed.

From Dr. J. Bequaert, of the Museum of Comparative Zoology, Cambridge, Mass., I am very much indebted for the loan of Jacot's topotype material, and the following re-description is drawn up from the five specimens:

Adult. Colour (in life red). Of typical *Trombicula* facies. Length to 1,300μ. Width across propodosoma to 1,040μ, across hysterosoma to 780μ. Crista linear, 195μ long, with subposterior diamond-shaped sensillary area with distally ciliated filamentous sensillae to ca. 112μ long, and their bases 61·6μ apart; epistome apparently rounded-conical with dentate margin and epistomal seta to 56μ long. Eyes 1 + 1, closely adjacent to sensillary area. Chelicerae with finely serrate inner (dorsal) edge. Palpi stout, tibia with claw and 3 strong accessory spines at base of claw, on outer side with a long nude spine-like seta; tip of tarsus with ca. 7–8 nude setae. Dorsal setae tapering with fine ciliations, on propodosoma to 28μ long, posteriorly on hysterosoma to 56μ long. Legs, I longer and stronger than the rest to 975μ, II 520μ, III ?, IV 715μ; tarsi I 240μ by 92·6μ high (mean of 4 spec., ratio length to height = 2·59 : 1·0), metatarsi I 169μ long (ratio length tarsi I to metatarsi I = 1·43 : 1·0).

Male unknown.

Remarks. In the proportions of the front tarsi and metatarsi this species is nearer to *alfreddugesii* than to *splendens*, but seems to be distinct therefrom as in the key.

TROMBICULA (TROMBICULA) WICHMANNI (Oudemans 1905).

Trombidium wichmanni Oudemans 1905, Ent. Ber., 7, (22), 217; *idem* 1906, Nova Guinea, 5, 106, 132.

Trombicula mediocris Berlese 1912, Redia, 8, (1), 95; Hatori 1919, Ann. Trop. Med. & Parasit., 13, 233; Kawamura and Yamaguchi 1921, Kitasato Archiv. Exp. Med., 2, 169; Sig Thor and Willmann 1947, Das Tierreich, Lfg. 71b, 348.

Trombicula pseudoakamushi Hatori 1919, Ann. Trop. Med. & Parasit., 13, 233 (*non* Tanaka *et al.* 1930, Zentrbt. Bakt. Orig., 116, 335); Walch 1923, Kitasato Archiv. Exper. Med., 5, 63; Hirst 1929, Ann. Mag. Nat. Hist., (10), 3, 564.

Trombicula pseudoakamushi var. *deliensis* Walch 1924, Trans. Vth. Bien. Congr. Far East. Assoc. Trop. Med., 691; *idem* 1924, Geneesk. Tijds. Ned. Indie, 64, (3); *idem* 1925, Kitasato Archiv. Exper. Med., 6, 235.

Trombicula hirsti Sambon 1927, Ann. Mag. Nat. Hist., (9), 20, 157.

Trombicula hirsti var. *buloloensis* Gunther 1939, Proc. Linn. Soc. New South Wales, 64, 78; *idem* 1939, *ibid.* 466.

Trombicula minor, Gunther 1939, Proc. Linn. Soc. New South Wales, 64, (5–6), 466 (*non* Berlese 1912, Redia, 8, (1), 93); Womersley 1939, Tr. Roy. Soc. S. Austr., 63, 149; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 92 (*non* Berlese 1912); Gunther 1940, Proc. Linn. Soc. New South Wales, 65, (5–6), 477–478 (*non* Berlese 1912).

Trombicula minor var. *deliensis,* Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 94.

For further synonymy see Larval Section.

Plate 89, fig. E–I.

Oudemans originally described the larvae of *wichmanni* from *Goura coronata* from New Guinea and from man from the North Celebes. In 1919 Hatori referred to but did not describe a larval *Trombicula* from Formosa under the name of "*pseudoakamushi* (*non* Tanaka)" and claimed to have obtained larvae from captured adults which he considered identical with *Trombicula mediocris* Berlese from Java.

In 1921 Kawamura and Yamaguchi, working also on Formosan material, described and figured in detail what they regarded as Hatori's species and affirmed his opinion that the adults were *mediocris.*

In 1917, Miyajima and Okumura (Saikin Zasshi, 266; 893–908, in Japanese) described and figured the adult of a species of *Trombicula* which they doubtfully referred to *mediocris.* At the same time they described a "thin-haired" type of larvae, which they compared with the European *autumnalis* pointing out some of the differences therefrom. From the very excellent figures both of the larvae and adult, it is reasonably certain that the larvae can be referred to *wichmanni* Ouds. and the adult to *mediocris* Berlese.

Walch 1923 recorded larvae from Deli, Sumatra, as *pseudoakamushi* Hatori, and in 1924a, and 1924b, and 1925 referred it to a variety *deliensis* of this species, and figured the crista and eyes, palpi and dorsal setae.

In 1929, Hirst suggested the possibility that the larvae, *hirsti* Sambon 1927 from Queensland, might be conspecific with Oudemans *wichmanni.* Carl Gunther 1939 described larvae from New Guinea as *T. hirsti* var. *buloloensis,* and later in the same year, as a result of having reared nymphs, considered *hirsti* as a synonym of *minor* Berlese. This was followed by Womersley 1939 and Womersley and Heaslip 1943. In 1943 Womersley and Heaslip regarded the variety *deliensis* Walch as belonging to *minor* Berlese. For the Formosan *pseudoakamushi* Hatori, Womersley and Heaslip after showing that the name was invalid proposed the name *hatorii* and further showed that it was closely

related to *wichmanni*, only differing in the higher values of AM, AL, PL and Sens. and in the larger ratio of PW/SD.

Towards the end of 1944 I received from Major R. N. McCulloch, four adult *Trombicula* collected in soil, New Guinea, from which he had successfully reared a number of larvae which were identified at the time as *T. hatorii* Wom. and Heasp. These adults, on examination were found to agree entirely with the figures and data given by Kawamura and Yamaguchi for their Formosan *mediocris* as well as with Berlese's figures and description, except that they were red in life, not white as given by Berlese. This had been noted by Kawamura and his colleagues, and it was suggested that Berlese's specimens had been bleached by the spirit.

The above New Guinea specimens also agree very well with the figures of the nymphs of *pseudoakamushi* var. *deliensis* given by Walch.

There seems little doubt therefore, that *wichmanni* Ouds. is the name by which this species should be known, as given in the above synonymy. Whether it is to be further synonymized with *minor* Berlese 1904, as has been done by Gunther 1939, 1940, and by Womersley 1939, and Womersley and Heaslip 1943, is somewhat doubtful, for following the re-description of the types of *minor* by Willmann 1941 (Zool. Anz., 133, 131–136) this species appears to be different (see under *Trombicula minor*). These differences, however, are rather small and quite possibly it may be later established that *wichmanni* Ouds. 1905 is synonymous with *minor* Berlese 1904. Dr. H. S. Fuller has expressed to me in a letter his opinion that *pseudoakamushi* is the same as *wichmanni*, and I have seen a preparation in the Oudemans' collection at Leiden given to Oudemans by Walch of 3 nymphs labelled *pseudoakamushi*, bred from larvae by Walch. These not only agree well with Walch's figures, but also in the crista with Willmann's 1941 figure for *minor* Berlese.

In describing his methods of obtaining larvae from adults captured in the field Major McCulloch (*in lit.*) states:

"The adult specimens, later determined as *mediocris*, were collected at Lae, on April 9th and 10th, 1944. In searching for them and keeping them (and also the larvae) in the laboratory, I followed the advice of Maj. G. M. Kohls. In jungle where larval mites were relatively numerous litter was scraped from the soil and adults watched for on the surface, then in the top inch of soil and finally in some patches by digging and crumbling the soil down to about six inches. In 2 days about 15 adult red Trombiculids were found on or close to the surface. There were also present at various depths more numerous and larger mites, probably adult Erythraeidae, etc.

"The adult Trombiculids were tubed individually each with about a tea-

spoonful of moist soil, previously sterilized by steaming, from the locality. The test tubes were closed by corks, perforated to allow aeration, covered with calico and inverted into the tubes to give a tight fit so that the larvae could not force their way into any space between the edge of the cork and the glass. The specimens were kept in the laboratory where the temperature varied between 74° F. in the early morning and 85–88° F. in the afternoon. A few drops of water were added to the soil in each tube from time to time, and a little condensed moisture was always present on the inner wall of the tubes. In this manner larvae of *Schöngastia blestowei* were kept alive for as long as 46 days.

"The living adult Trombiculids were examined from time to time as other work allowed. On May 15th it was observed that one had produced more than a dozen larvae, apparently sometime earlier. No eggs were found. Some of the other adults had died, and the remainder had then to be killed. The specimens of larvae were then forwarded to Adelaide for identification."

As previously stated the above larvae were identified as *T. hatorii* Wom. and Heasp. 1943 (= *wichmanni* Ouds. 1905) and the adults as *mediocris* Berl. 1912.

The following description of the adult is based on the above New Guinea specimens; that of the nymph is from those reared from larvae by Kawamura and Yamaguchi, who gave little detail, and by Walch; both from *T. pseudoakamushi* Hatori.

Adult. Colour in life red. Of typical *Trombicula* facies, with constriction between second and third pairs of legs. Length 1,100μ (Berlese 1,550μ; Miyajima and Okumura 1,450μ); width across propodosoma 525μ, across hysterosoma 675μ (Berlese max. 900μ; Miyajima and Okumura max. 830μ). Crista 197μ long, linear, with subposterior more or less triangular broad sensillary area, with paired filamentous sensillae, which are closely and shortly barbed basally, and with more open longer ciliations distally; (other students make no reference to the sensillae having barbs on the basal portion); sensillae bases 62μ apart. Epistome rounded, finely denticulate with 1 ciliated seta to 60μ long. (Miyajima and Okumura for their specimens from Formosa figure the epistome as truncate anteriorly, with no lateral denticulations. This feature, however, is extremely hyaline and difficult to make out). Chelicerae with inner (dorsal) concave margin finely denticulate. Palpi fairly stout; tibia with simple claw, and 3 accessory spines at base thereof, and a fourth about midway between base of claw and articulation of palpal tarsus; tarsus widest medially and slightly over-reaching tip of claw. Eyes fairly large with distinct corneas, one on each side, close to sensillary area and postero-lateral of sensillae bases.

Legs all shorter than body, I the longest and strongest 945μ long, II 525μ, III 525μ, IV 600μ; tarsus I 208μ long by 100μ high, metatarsus I 135μ long (Berlese gives tarsus I 210μ by 80μ, metatarsus 140μ; Miyajima and Okumura figure tarsus rather more than two and half times as long as wide). Sternum entire, about as wide as long; no precoxal plates on leg I. Dorsal setae from 25μ anteriorly to 55μ posteriorly (Berlese gives 25μ to 70μ; Miyajima and Okumura give 25–50μ), setae uniformly thick with moderately long ciliations. Genital aperture with 3 pairs of discs. In the male, with four spathulate fimbriated "titillating" setae as described and figured for *alfreddugesii* Ouds.

Nymph. As in adult but smaller and with the usual nymphal characteristics as only 2 accessory spines at base of palpal claw, and only 2 pairs of genital discs. Crista 106μ long, SB 40μ. Sensillae ca. 99μ plus. Tarsi I 116μ long by 60μ high; metatarsi I 79μ. Dorsal setae as in adult 25μ to 45μ long.

Material seen. Three adults from Lae, New Guinea (R. N. McCulloch), one adult from Innisfail, Queensland, previously recorded as *minor* Womersley and Heaslip 1943 (W.G.H.); three adults from New Guinea, Dobodura area, April, 1944 (G. M. Kohls); one adult from damp soil, Goodenough Island, August, 1944; one adult from soil, Admiralty Island, Aug., 1944 (NAMRU II 132, G.W.W.).

Two nymphs reared by Dr. C. Gunther, in New Guinea, Bulolo area, 1939, and one reared by Maj. Kohls, Dobodura area, New Guinea, 1944 (No. 19, G.M.K.).

Remarks. With regard to the habitat in which the adults were found Maj. McCulloch writes me as follows: "That they were all *mediocris* is most interesting in view of the fact that they came from ground where the overwhelmingly abundant larvae were *Schöngastia blestowei.* Because of its relatively high mite infection this ground was used for weeks as a test area, and at least 50 larvae were collected on boots and identified daily. About 99% were *S. blestowei,* the rest either *S. parva* Wom. 1944 (= *schuffneri* Walch) or *T. hatori* (previously identified by me as *wickmanni*) but referred by Womersley to *hatorii.*"

TROMBICULA (TROMBICULA) SAMBONI Womersley 1939.

Trombicula samboni Womersley 1939, Tr. Roy. Soc. S. Austr., 63, (2), 153.

Trombicula hirsti, Hirst 1929, Ann. Mag. Nat. Hist., (10), 3, 564, *non* Sambon, 1927, *ibid.* (9), 20, 157; Womersley 1934, Rec. S. Aust. Mus., 5, (2) 212, *nec* Sambon, 1927. All as larvae.

Trombicula samboni, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 95, (adult).

Plate 89, fig. J–O.

Adult. Colour in life red. Of typical *Trombicula* facies with constriction between second and third pair of legs. Length to 1,200μ, width across propodosoma 690μ, across hysterosoma 860μ. Crista well developed, 170μ long, rod-like with wide, roughly diamond-shaped subposterior sensillary area, with paired sensillae 118μ long and shortly ciliated on distal half, their bases 47μ apart. Eyes one on each side, large and closely adjacent to sensillary area, deeply pigmented in life, but rather difficult to see in preparations. Epistome rounded-conical, finely denticulate, with 1 setae. Chelicerae with the inner (dorsal) edge finely serrate. Palpi moderately slender; tibia with 3 accessory spines at base of claw. Legs all shorter than body; I the longest and strongest, 775μ long, II 520μ, III 600μ, IV 680μ; tarsus I 206μ long by 86μ wide, metatarsus I 137μ long. Sternum entire, about as wide as long; no precoxal plates on leg I. Clothing of dense, ciliated, pointed setae, to 40μ long posteriorly, the ciliations long and outstanding. Genital opening with 3 pairs of discs.

Nymph. Similar to adult in all details except size, with only 2 pairs of genital discs and 2 accessory spines at base of palpal tibial claw. Length to 1,000μ; width across propodosoma 600μ, across hysterosoma 720μ.

Remarks. This species is only known from South Australia, where since the extermination of the native fauna it has established itself as larvae on the introduced rabbit.

Subgenus **LEPTOTROMBIDIUM** Nagayo et al. 1917.

J. Exper. Med., 25, (2), 255, 1917.

Genotype *Trombidium akamushi* Brumpt 1910.

Nagayo, Miyajima, Mitamura and Imamura, 1917 proposed this generic name for the Japanese species *akamushi* Brumpt, on various differences from "other trombidia". In 1921, however (Amer. J. Hygiene, 1, (5, 6), 588), they adopted Berlese's name of *Trombicula.*

In 1946 (Proc. Entom. Soc. Washington, 48, 171–178) Wharton pointed out that the proved vectors of tsutsugamushi disease belonged to a small group of larval species, which he defined as the "*akamushi*" group of the genus *Trombicula.* In the present studies it is further shown that, where the larvae of this group of species have been reared to and correlated with adults or nymphs, they are also distinct generically from other *Trombicula* species. Thus a new generic name is required, and that proposed by Nagayo *et al.* 1917, for *akamushi* is available. The diagnosis of the genus is as follows:

Adult and Nymph. Facies as in *Trombicula* with marked constriction between propodosoma and hysterosoma. Crista elongate with roughly diamond-

shaped sensillary area, with internal areola and a pair of filamentous sensillae. Epistome rectangular with the anterior margin slightly concave or sinuous, with fine denticulations on the shoulders and with 1 ciliated seta. Eyes absent. Tarsi of leg I tapering, widest basad of middle. Coxae of leg I with precoxal plates, which form a longitudinally divided sternum.

Key to the Known Adults and Nymphs.

1. Dorsal setae ending in a hyaline knob, or small spathulation 2
   Dorsal setae not so 6
2. Dorsal setae posteriorly terminating in a hyaline knob 3
   Dorsal setae posteriorly terminating in a small spathulation 4
3. Dorsal setae shorter, more uniform from 30μ to 45μ long. Tarsi hardly twice as long as high; half as long again as metatarsi.
   Trombicula (*L.*) *deliensis* (Walch 1922).
   Dorsal setae longer, from 30μ anteriorly to 90μ posteriorly. Tarsi I more than twice as long as high; half as long again as metatarsi.
   Trombicula (*L.*) *pallida* (Nagayo *et al.* 1917).
4. Posterior dorsal setae to 60–80μ long 5
   Posterior dorsal setae to 56 μ long. Metatarsi I about as long as tarsi are high. *Trombicula* (*L.*) *burmensis* Ewing 1945.
5. Metatarsi I longer than tarsi are high.
   Trombicula (*L.*) *fulleri* Ewing 1945.
   Metatarsi I about as long as tarsi are high.
   Trombicula (*L.*) *longiseta* sp. n.
6. Dorsal setae posteriorly to 110μ; ending in a strong sigma-like spinule. Tarsi I more than twice as long as high; half as long again as metatarsi. *Trombicula* (*L.*) *myzantha* sp. n.
   Dorsal setae shorter, posteriorly to 70μ, uniformly thick, and not ending in such a spinule. Tarsi I two and a half times as long as high; half as long again as metatarsi.
   Trombicula (*L.*) *akamushi* (Brumpt, 1910).
   (= *fletcheri* Wom. and Heasp. 1943).

TROMBICULA (LEPTOTROMBIDIUM) DELIENSIS (Walch 1922).

Trombicula deliensis Walch 1922, Kitasato Archiv. Exper. Med., 5., (3), (larva); for other larval synonymy see Larval Section.

Trombicula deliensis, Walch 1922, Geneesk. Tijds. Neder. Indie, 64, (3), 514; *idem* 1924, Tr. Vth. Bien. Congr. Far East. Assoc. Trop. Med., Singapore, 583; Radford 1946, Parasitol., 37, (102), 42–45; *idem* 1946, *ibid.* 46–54; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 98; Sig Thor and Willmann 1947, Das Tierreich, Lfg. 71b.

Plate 90, fig. A–G.

The nymph of this species was first reared from larvae and described by Walch from Deli, Sumatra, when the entire animal, crista, chelicera, palp and dorsal seta as well as the sternum were figured. The crista was shown as having a somewhat dumb-bell shaped sensillary area with the postero-lateral corners angular; the anterior rod was only indicated by a fine line, the outer borders not being shown; no epistome was indicated, but a single ciliated epistomal seta was figured. The sensillae were shown as shortly barbed on the basal part, with longer ciliations distally. The dorsal setae were figured with almost even thickness and ciliations, with at the apex a hyaline knob or blob. The sternum was shown as being divided longitudinally.

Radford (1946) also reared nymphs from larvae in Ceylon, and later was able to correlate them with adults found in the field. In his first paper Radford gives fairly good figures of this species, and of certain details. The crista is shown more clearly and the posterior triangular projection of the sensillary area is indicated.

Dr. Radford has very kindly presented me with a number of adults as well as two nymphs of this species from which the following re-description and figures are drawn:

Adult. Length 800μ to 1,030μ excluding capitulum (Radford gives 1,200μ including capitulum and 900μ without); width across propodosoma 300μ to 470μ (Radford 600μ), across hysterosoma 400μ to 660μ (Radford 675μ). Facies as in *Trombicula* with pronounced median constriction. Colour in life red. Crista linear, 151–160μ long (Radford 144μ), with diamond-like subposterior sensillary area, and paired filamentous sensillae, distally ciliated, the sensillae bases 61μ to 66μ apart (Radford 68μ). Epistome transverse rectangular, with denticulations anteriorly and 1 ciliated seta. Palpal tibia with 3 accessory spines at base of claw. Chelicerae finely serrate on inner edge. Legs: I 660μ to 820μ long (Radford 675μ), II 440μ to 460μ (Radford 450μ), III 400μ to 500μ (Radford 450μ), IV 530μ to 600μ (Radford 630μ); tarsi I 182μ to 191μ long by 97μ to 106μ high; metatarsi I 115μ to 121μ long. Precoxal plates of leg I well developed, and conjoined to form a longitudinally divided sternal plate. Dorsal setae posteriorly to 45μ long (Radford 74μ), uniformly thick and ciliated, and apically with a conspicuous hyaline knob or blob. Genital discs 3 pairs; in the male without any specialized setae.

Nymph. Generally as in adult, but with the characteristic genital and palpal differences. Length 600μ; width across propodosoma 320μ, across hysterosoma 380μ (Walch gives 456μ, 264μ and 276μ respectively. Radford gives no

values). Crista 106μ long (Walch 74μ; Radford 102μ); width between sensillae bases 45μ (Walch 33μ; Radford 51μ). Tarsi I 106μ long by 63μ high; metatarsi I 66μ long (Walch gives ratio of length to height of tarsi I as 2·2, and of length of tarsi I to metatarsi I 1·60; Radford gives no values). Posterior dorsal setae as in adult, to 45μ long (Walch gives 56μ, Radford no value). Palpal tibia with only 2 accessory spines at base of claw. Genital discs 2 pairs.

Remarks. The peculiar tip to the dorsal setae is also characteristic of *pallida* Nagayo *et al.;* and of *N. clavicata* André. The first of these species, however, differs in the dorsal setae being thinner and longer, while *N. clavicata* André is a French species. *Leptotrombidium akamushi* which in the larval stage is closely allied to *deliensis* is, however, very distinct in the adult, in the form of the dorsal setae.

TROMBICULA (LEPTOTROMBIDIUM) PALLIDA (Nagayo *et al.* 1919).

Trombicula pallida Nagayo *et al.* 1919, Verdhl. d. jap. pathol. Gesellsch., Tokyo, 9, 107; *idem* 1921, Amer. J. Hyg., 1, (5–6), 569; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 98; Sig Thor and Willmann, 1947, Das Tierreich, Lfg. 71b, 349.

Plate 90, fig. N–S.

Nagayo *et al.* (1921) claimed to have reared this species through from larvae to adult and to have recognized the adults captured in the field. They were unable, however, to find specific differences between the adults and nymphs of this species, and those of *akamushi, palpalis,* and *scutellaris,* except that in *pallida* the minute setules on the basal part of the sensillae were much longer and more prominent than in the other species, and that the nymphs and adults of *akamushi* were much lighter in colour.

I have before me a preparation from Prof. Dr. Takenouchi containing an adult caught in the field in Yamagata Prefecture, Japan, in July, 1920, and stated in his letter to be "probably *T. pallida*". In addition I have two slides of specimens, collected also in Yamagata Prefecture, by Col. C. B. Philip, which agree with that from Takenouchi. All three specimens have the posterior dorsal setae much longer than in *deliensis,* and these setae have the similar hyaline terminal knob, a feature not observed by Nagayo and his colleagues. A re-description drawn up from these specimens is as follows:

Facies generally as in *Trombicula,* with the prominent constriction between coxae II and III. Colour reddish. Length 1,000–1,200μ; width across propodosoma 490–610μ, across hysterosoma 613–800μ. Crista linear 151μ long, with sensillae shortly barbed basally, rather longer barbs or cilia distally, 121μ long, and their bases 51μ apart. Palpi stout; tibia with 3 accessory spines at base of

claw. Chelicerae finely serrate on inner margin. Epistome transverse rectangular, anterior margin straight or slightly concave, denticulate, with 1 ciliated seta. Legs: I 700μ long, II 420–500μ, III 460–510μ, IV 530–600μ; tarsi I 196μ long by 94μ high, metatarsi I 118μ long. Sternum about as wide as long, longitudinally divided, by the junction of precoxal plates of leg I. Dorsal setae gradually increasing posteriorly to 90μ long, slender and parallel sided with strong setules and an apical hyaline knob or swelling. Genital discs 3 pairs. Male unknown.

TROMBICULA (LEPTOTROMBIDIUM) AKAMUSHI (Brumpt 1910).

Trombidium akamushi Brumpt 1910, Précis de Parasit., 2nd. ed., 506 (larva).

For further larval synonymy see Larval Section.

Leptotrombidium akamushi, Nagayo *et al.* 1917, J. Exper. Med., 25, (2), 255.

Leptus akamushi, Miyajima and Okumura 1918, Kitasato Archiv. Exper. Med., 1, (1), 1–14.

Trombicula akamushi Nagayo *et al.* 1921, Amer. J. Hyg., 1, (5, 6), 588; Hatori 1919, Ann. Trop. Med. Parasit., 13, (3), 233; Kawamura and Yamaguchi 1921, Kitasato Archiv. Exper. Med., 4, 169; Walch 1923 (1924), Tr. Vth. Bien. Congr. Far East. Assoc. Trop. Med., Singapore; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 84; Sig Thor and Willmann 1947, Das Tierreich, Lfg. 71b.

Trombicula coarctata, Kitashima and Miyajima 1918, Kitasato Archiv. Exper. Med., 2, 190–191, pl. 8, fig. 1 (*non* Berlese 1912); Ewing 1920, Ann. Entom. Soc. Amer., 13, 111 (*non* Berlese 1912); *idem* 1933, Proc. U.S. Nat. Mus., 82, 2 (*non* Berl. 1912).

Plate 90, fig. H–M.

This species, the larvae of which are the proved vectors of the tsutsugamushi fever of Japan and the Pacific area, is probably the best known and best figured of the Trombiculidae.

Although there has been much confusion amongst authors as to what is the true adult of *akamushi,* the studies of Nagayo and his colleagues, of Walch, and particularly of Miyajima and Okumura have given very excellent descriptions and figures.

From the above literature the life cycle of this species is generally fairly well established, and is discussed elsewhere in this paper.

Nagayo *et al.,* however, in 1921, reported the rearing of nymphs and adults of three other closely related species of larvae, viz. *pallida, palpalis,* and

scutellaris, but they were unable to distinguish the nymphs and adults on satisfactory morphological characters, except that in *pallida* the pigment colouration was deeper and the minute barbs on the basal part of the sensillae were distinctly longer than in the other species. They did, however, separate them on the seasonal occurrence of the larvae.

In the present paper it has already been shown that *pallida* can be separated from the other above mentioned species on the structure of the dorsal setae. Of *palpalis* and *scutellaris* I have not seen any adults or nymphs, and cannot separate these for the present.

Of authentic material of *akamushi* I have a preparation of 4 adults from Kawamura and collected in Niigata Prefecture, Japan. In addition I have been able to study 6 nymphs reared in New Guinea by Maj. G. M. Kohls from larvae identified as *T. fletcheri* Wom. and Heasp. 1943, a species now regarded as synonymous with *akamushi* Brumpt. Three of these nymphs were from larvae on a quail, Dobodura, N.G., June, 1944 (No. 376, G.M.K.) and three from larvae on a rat, New Guinea 1944 (No. 156, G.M.K.).

Apart from the usual differences found between nymphs and adults these nymphs do not differ from the Japanese adults, thus supporting the synonymy of *fletcheri* with *akamushi.* The following description and figures are from these specimens:

Re-description of Adult. Of typical *Trombicula* facies, with usual median constriction. Colour in life light to pale yellowish. Length to 1,000μ; width across propodosoma to 490μ, across hysterosoma to 535μ. Crista linear, 165μ long, with subposterior sensillary area with paired filamentous sensillae, 150μ long, with minute barbs basally and longer ciliations distally; sensillae bases to 65μ apart. Epistome transverse rectangular with anterior edge slightly concave medially and with fine denticles. Eyes absent. Palpi stout; tibia with 3 accessory spines at base of claw and a fourth midway between base of claw and articulation of palpal tarsus. Chelicerae with inner edge finely serrated. Legs all shorter than body; tarsi I 205μ by 90μ high (Hatori 180$\mu \times$ 70μ); metatarsi I 136μ long. Sternum distinct, about as wide as long, divided longitudinally by the junction of the precoxal plates of leg I. Dorsal setae uniformly thick, 35μ to 45μ long posteriorly, ciliated to tip. Genital discs 3 pairs. Male unknown.

Re-description of Nymph. As in the adult except for nymphal characteristics. Crista 104μ long; sensillae 120μ long, their bases 44μ apart. Tarsi I 100μ long by 58μ high, metatarsi I 63μ long. Dorsal setae as in adult, 20μ to 45μ long.

TROMBICULA (LEPTOTROMBIDIUM) MYZANTHA sp. n.

Plate 91, fig. A–G.

This species is known from both larvae and nymphs. These nymphs, reared from larvae from various birds (see hosts in Larval Section) by Mr. D. A. Gill from Yerongpilly, Queensland, 18th Dec., 1944, and two others from the same locality, 5th April, 1945.

The species is separated from all other known adults or nymphs on the peculiar anterior and posterior dorsal setae, as given in the key.

Description of Nymph. Of typical *Trombicula* facies, with median constriction between second and third pairs of legs. Colour in life red. Length 1,066μ to 1,330μ (aver. of 5 specimens, 1,225μ); width across propodosoma 600μ to 800μ (aver. 718μ), across hysterosoma, 640μ to 860μ (aver. 796μ). Crista typical of the genus, 190μ to 212μ long (aver. 199μ), with subposterior sensillary area, with paired filamentous sensillae, 120μ long, with minute barbs basally and short ciliations distally; sensillae bases 45μ apart. Eyes absent. Chelicerae finely serrated on inner edge. Palpi rather slender; tibia with 2 accessory spines at base of claw. Epistome transverse rectangular, anterior margin denticulate, with 1 ciliated seta. Legs all shorter than body, I 750μ to 860μ long (aver. 796μ), II 470μ to 560μ (aver. 502μ), III 490μ to 570μ (aver. 523μ), IV 530μ to 660μ (aver. 593μ); tarsi I fairly elongate, widest basad of middle, 197μ to 220μ (aver. 212μ) long by 82μ to 90μ (aver. 88μ) high, metatarsi I 121μ to 136μ (aver. 128μ) long. Sternum about as wide as long, with median longitudinal bar at the junction of the precoxal plates of leg I. Dorsal setae of two forms, anteriorly to 30μ long, somewhat clavate, becoming more slender and longer posteriorly to 110μ, and terminating in a distinct sigma-shaped spinule, not clavate; all setae with short ciliations.

TROMBICULA (LEPTOTROMBIDIUM) FULLERI (Ewing, 1945).

Trombicula fulleri Ewing 1945, Proc. Ent. Soc. Washington, 47, (3), 46.

Plate 92, fig. F–J.

Description of Nymph. Of typical *Trombicula* facies. Length 710μ; width across propodosoma 383μ, across hysterosoma 454μ. Crista with triangular sensillary area and dumb-bell shaped areola, 128μ long, sensillae filamentous, barbed basally, and with short ciliations distally, to 120μ long, and bases 57μ apart. Chelicerae finely serrated on inner margin. Palpi stout, tibia with simple claw and 2 stout spines at base of claw. Eyes absent. Legs: I longer and stronger than the rest 497μ, II 312μ, III 312μ, IV 383μ; tarsi I 130μ long

by 80μ high, metatarsi I 105μ long. Body setae fairly long and strongly ciliated, posteriorly to 60–80μ long and apically with a small spathulation.

Remarks. This species is described from eight nymphs reared from larvae from Imphal 1945, by K. L. Cockings, the larval pelts being correlated with the larval description.

TROMBICULA (LEPTOTROMBIDIUM) LONGISETA sp. n.

Plate 92, fig. A–E.

Description of Nymph. Of typical *Trombicula* facies. Length to 715μ; width across propodosoma 390μ, across hysterosoma 455μ. Crista elongate, to 122μ, with subposterior sensillary area, furnished with paired sensillae to 98μ with short barbs on basal half and ciliations distally; sensillae bases 53μ apart. Epistome not discernible, epistomal seta to 28μ long. Chelicerae finely serrate on dorsal edge. Eyes absent. Palpi stout, with two accessory spines at base of claw. Legs: I stronger than rest and to 585μ, II 390μ, III 390μ, IV 455μ; tarsi I slightly less than twice as long as high, 136μ by 77μ, metatarsi I 80μ long. Leg I with distinct precoxal plates forming a longitudinally divided sternum. Dorsal setae anteriorly ciliated and tapering, from 25μ long, lengthening posteriorly to 60–80μ long; the posterior setae apically with a thickened tip as in fig. E. Genitalia with paired discs.

Remarks. The nymph of this species is described from two specimens reared from larvae from Imphal, Burma, No. 169, 16 Aug., 1945, and No. 289, 28 Aug., 1945, by Mr. K. L. Cockings, and the identification checked with the larval pelts.

In the larva, the species is closely related to *deliensis*, differing in the excessively long PL but in the nymph, it comes nearer to *fulleri*.

TROMBICULA (LEPTOTROMBIDIUM) BURMENSIS (Ewing 1945).

Trombicula burmensis Ewing 1945 (as larvae), Proc. Entom. Soc. Washington, 47, (3), 64.

Plate 91, fig. H–L.

Description of Nymph. Of typical *Trombicula* facies. Length 710μ; width across propodosoma 420μ, across hysterosoma 560μ. Crista with diamond-shaped sensillary area and dumb-bell shaped areola; to 112μ long; sensillae filamentous, barbed basally, shortly ciliated distally, to 110μ long, and their bases 56μ apart. Eyes absent. Palpal tibia with simple claw and two strong blunt

spines at base of claw. Legs: I longer and stronger than rest, to 500μ long, II 312μ, III 350μ, IV 448μ; coxae I with distinct precoxal plates forming a longitudinally divided sternum; tarsi I 128μ long by 80μ wide; metatarsi I 78μ long. Dorsal setae fairly uniform, strongly ciliated, apically with spathulate tip, posteriorly the setae reach to 56μ in length.

Remarks. This nymphal description is drawn up from 3 nymphs reared from larvae from Imphal, India, by K. L. Cockings, the recovered pelts being correlated, and their identification as larvae checked. As with all the species of *Trombicula,* specific separation of the nymphs or adults is extremely difficult and unsatisfactory. The key given above is only an attempt to separate the species.

Subgenus NEOTROMBICULA Hirst 1926.

Ann. Applied Biol., 13, 140–143. Genotype *Acarus autumnalis* Shaw 1790.

Hirst raised this subgenus in 1926 for the nymph of *Trombicula autumnalis* (Shaw 1790), on apparently slight but rather poorly specified differences from typical *Trombicula* as in *akamushi* Brumpt. These differences were mainly the more elongate form, and the absence of eyes.

It is now possible to more precisely define the genus, as below, and to include a number of other species.

Diagnosis of Genus. Rather more elongate but typical of *Trombicula* with the median constriction between legs II and III. Crista linear, with roughly diamond-shaped or rounded sensillary area furnished with two filamentous sensillae. Epistome rounded or subtriangular with fine teeth or denticles and 1 ciliated seta. Eyes absent. Palpi rather slender; tibia with 3 accessory spines at base of claw (2 in nymph) and a fourth between base of claw and articulation of palpal tarsus; occasionally palpal tibia also with pectine. Chelicerae with inner edge serrated. Legs shorter than body. Sternum entire, about as wide as long, undivided; no precoxal plates evident. Dorsal setae various. Genital aperture with 3 pairs of discs in adult (2 in nymph).

Key to Known Adult and/or Nymphal Species.

1. Palpal tibia with pectine, in addition to the 3 accessory spines at base of claw. Posterior dorsal setae spathulate apically, to 40μ long, ciliated. *Trombicula (N.) scincoides* (Wom. 1944).
   No such pectine on palpal tibia 2
2. Sensillae nude 3
   Sensillae ciliated, at least distally 5

3. Posterior dorsal setae to ca. 40μ long 4
Posterior dorsal setae to 110μ long, with few long outstanding setules. Front tarsi twice as long as high.
Trombicula (*N.*) *inopinatum* (Ouds. 1909).

4. Posterior dorsal setae clavate or spathulate apically in dorsal view, ciliated to tip, to 30μ long. Tarsi of leg I nearly 3 times as long as high. *Trombicula* (*N.*) *rara* (Walch 1924).

Posterior dorsal setae normal, to 36μ long. Tarsi of leg I not quite twice as long as high. *Trombicula* (*N.*) *hastata* (Gater 1932).

5. Dorsal setae with a prominent apical trilobed knob, stem with strong setules. *Trombicula* (*N.*) *jayewickremei* sp. n.

Dorsal setae otherwise 6

6. Posterior dorsal setae long and slender, to 350μ, ciliated, apical fifth spine-like, but with a few subterminal fibrillae.
Trombicula (*N.*) *canestrinii* (Buffa 1899).

Posterior dorsal setae otherwise 7

7. Dorsal setae parallel sided, terminating in a hyaline knob, from 22μ long anteriorly to 70μ long posteriorly. Sensillae fine and slender with short ciliations. *Trombicula* (*N.*) *clavicata* André 1932.

Dorsal setae not so 8

8. Front tarsi at least 5 times as long as high 9

Front tarsi not more than 3½ times as long as high 10

9. Front tarsi ca. 5 times as long as high. Dorsal setae 40–50μ long anteriorly, 110μ posteriorly. *Trombicula* (*N.*) *formicarum* (Berl. 1910).

Front tarsi ca. 8 times as long as high. Epistome with occasionally 2 setae. Dorsal setae long and slender, to 250μ, with ciliations. Palpal tibia with 4 (?) accessory spines at base of claw.
Trombicula (*N.*) *camilla* (Wharton 1938)

10. Sensillae rather thick for whole length, with short ciliations on entire length. A pair of long ciliated specialized setae in front of sensillary area. Dorsal setae of two sizes, anteriorly mainly 14μ long, posteriorly 40μ. *Trombicula* (*N.*) *spicea* (Gater 1932).

Sensillae much more filamentous. No such specialized setae in front of sensillary area 11

11. Dorsal setae of about equal length throughout, 62–65μ. Colour in life light yellow to white (after Vitzthum).
Trombicula (*N.*) *russica* (Ouds. 1932).

Dorsal setae much longer posteriorly than anteriorly 12

12. Posterior dorsal setae to 40–45μ long 13

Posterior dorsal setae to ca. 100μ long 15

Posterior dorsal setae 30–35μ long 16

13. Posterior dorsal setae to 45μ long, with parallel sides and at the tip expanded into an oval hyaline knob, furnished with setules. The longer setae also interspersed as well as posterior. Tarsi I ca. twice as long as high, metatarsi I 3-5ths length of tarsi.
Trombicula (*N.*) *fordi* sp. n.

Posterior dorsal setae to 40μ, apically pointed with outstanding setules 14

Posterior dorsal setae to 35μ long 16

14. Tarsi I half as long again as metatarsi, and twice as long as high.
Trombicula (*N.*) *sarcina* (Wom. 1944).

Tarsi I only slightly longer than metatarsi.
Trombicula (*N.*) sp. n. (Cooreman *in litt.*)

15. Front tarsi ca. 3·3 times as long as high. Sensillae with only about 3 distal cilia, nude basally. Dorsal setae 45μ, anteriorly increasing gradually to 97μ posteriorly. *Trombicula* (*N.*) *moesica* (André 1932).

Front tarsi 2·5 times as long as high. Sensillae minutely barbed basally, and with 10–12 branches distally. Dorsal setae 30μ anteriorly, increasing to 110μ posteriorly.
Trombicula (*N.*) *autumnalis* (Shaw 1790).

16. Posterior dorsal setae to 30μ long, tapering with outstanding ciliations. Tarsi I ovoid, half as long again as high, and almost twice as long as metatarsi I. *Trombicula* (*N.*) *consueta* sp. n.

Posterior dorsal setae to 34μ long, parallel sided almost to tip. Tarsi I twice as long as high and as long as metatarsi I.
Trombicula (*N.*) *harrisoni* sp. n.

N.B.—The following four species, although doubtless to be placed in the subgenus *Neotrombicula* cannot be satisfactorily keyed on the data available in the original descriptions, and I have not been able to examine material; they are *coarctata* (Berl.), *cavernarum* (Ewing), *manriquei* (Ewing) and *goldii* (Ouds.).

TROMBICULA (NEOTROMBICULA) SCINCOIDES (Womersley 1944).

Trombicula scincoides Womersley 1944, Tr. Roy. Soc. S. Austr., 68, (1), 84 (larvae).

Plate 93, fig. A–F.

Originally only known from the larvae. I have since received from Maj. G. M. Kohls four nymphs which he was successful in rearing from fully engorged larvae, identified as this species, from a lizard from Dobodura, New Guinea, March 1st, 1944.

In addition from amongst a lot of miscellaneous acarina collected from soil near the 2/8 A.G.H., New Guinea, in April, 1944, were 3 adults and 1 nymph which can be referred to the same species as the reared nymphs. The descriptions of the nymphs and adults are as follows:

Adult. Of typical *Trombicula* facies. Colour in life red. Length to 1·125 mm.; width across propodosoma 0·825 mm.; across hysterosoma 0·9 mm. Palpi fairly stout, with a long and strong tibial claw, at the base of which are 3 strong blunt accessory spines; on the palpal tibia on the inner surface also is a pectine of from 7 to 9 strong spines; palpal tarsus elongate and reaching beyond tip of tibial claw. Chelicerae stout with about a dozen backwardly directed inner teeth. Crista elongate, linear, 227μ long, bifurcate apically and with a subposterior diamond-shaped sensillary area; sensillary area with a more or less dumb-bell shaped areola on which the sensillae bases are 63μ apart; ratio of SB (distance between sensillae bases) and entire length (including sensillary area) of crista = 3·6. Sensillae 180μ long, filamentous, ciliated distally. Epistome rounded, conical, with fine denticulations and 1 ciliated seta. Eyes absent. Legs all shorter than body; I much thicker and stouter than others, 975μ long, II 600μ, III 675μ, IV 870μ; tarsi I 213μ to 239μ long (aver. of 3 = 227μ) by 109μ to 121μ (aver. 115μ) high, giving ratio of 3·6:1·0; metatarsi I 167μ to 174μ long (aver. 115μ), giving a ratio of length of tarsi to metatarsi of 1·35:1·0. Sternum entire; no precoxal plates on leg I. Dorsal setae moderately thick-stemmed, increasing in length posteriorly from 24μ to 40μ, rather strongly curved and apically broadened or spathulate, with strong ciliations. Genital discs 3 pairs. In male sex, on each side of genital aperture with 3 nude strong curved spines, and a pair of large expanded and fringed titillating setae.

Nymph. Similar to adult except for nymphal characteristics and smaller size. Length to 0·83 mm., width across propodosoma 0·525 mm., across hysterosoma 0·62 mm. Eyes absent. Chelicerae and palpi as in adult but only two accessory spines at base of palpal tibial claw and 3 spines in the pectine of palpal tibia. Crista 150μ long, sensillae 140μ long with bases 45μ apart; ratio of length of crista to SB = 3·3:1·0. Legs as in adult, I 675μ, II 450μ, III 450μ, IV 530μ long; tarsi I 147μ long by 83μ high (aver. of 4 specimens), giving a ratio of 1·77:1·0; metatarsi I 117μ long, ratio of length of tarsi to metatarsi = 1·26:1·0. Sternum as in adult. Dorsal setae as in adult, varying from 20μ anteriorly to 35μ long posteriorly.

Remarks. This is rather a characteristic species and can be fairly readily recognized by the pectine on the palpal tibia and the structure of the dorsal setae.

TROMBICULA (NEOTROMBICULA) INOPINATUM (Ouds. 1909).

As larvae.

1893. *Trombidium gymnopterorum* Berlese, Order Prostigmata, 93, tab. 13, fig. 2, 3; tab. 15 (*non* Linné).

1903. May 14th. *Thrombidium gymnopterorum,* Ouds., Tijdsch. v. Entom., 45, 143.

1903. July 17. *Thrombidium gymnopterorum* Ouds., *ibid.,* 46, 5.

1904. March 14. *Thrombidium gymnopterorum,* Ouds. and Heim, in CR. Acad. Sci. Paris, 1.

1909. May 28. *Thrombidium inopinatum* Ouds., Tijds. v. Entom., 52, 43, tab. 37–40.

1909. May 29. *Thrombidium meridionale* Ouds., *Ibid.,* 52, 45.

1909. July 31. (Seance 17 July). *Trom. gymnopterorum* (*fuliginosum*) et *Allotrombidium gymnopterorum* (*fuliginosum*) Bruyant, CR. Soc. Biol. Paris, 67, 207.

1909. July 31 ? (Seance 17 July). *Trombidium inopinatum,* Bruyant, *ibid.,* 67, 208.

1909. Aug. 7 ? (Seance 24 July). *Trombidium* (*Heterotrombidium*) *inopinatum* Verdun, *ibid.,* 67, 246.

1909. Aug. 7 ? (Seance 24 July). *Trombidium* (*Heterotrombidium*) *meridionale* Verdun, *ibid.,* 67, 246.

1909. Nov. 1. *Microthrombidium inopinatum* Ouds. Entom. Ber., 3, (50), 17, 20.

1909. Nov. 1. *Microthrombidium meridionale,* Ouds. *ibid.,* 3, (50), 21.

1910. Jan. 18. *Microtrombidium pusillum* Bruyant, Zool. Anz., 35, (11), 351.

1912. *Microtrombidium pusillum,* Ouds. Zool. Jahrb. Suppl., 14, 31.

1912. *Acarus autumnalis,* Ouds., *ibid.,* Suppl. 14, 31.

As nymph.

1913. *Microtrombidium autumnalis,* Ouds. Arch. Naturg., 79A, 127 (Publ. 20/3/1914).

Plate 98, fig. H–M.

The status of this species has by most acarologists been accepted as synonymous with *autumnalis* Shaw, chiefly on the opinions expressed on several occasions by Oudemans himself, that the larvae described by him as *inopinatum* and as *meridionale,* the *gymnopterorum* Berlese (*non* Linne), were the same species as Shaw's.

In addition to the original description and figures of the larvae of this species (Tijds. v. Entom., 52, 43, taf. 7, fig. 37–40) I have a photostat copy of Oudemans' original drawings, No. 1,104, in the Leiden Museum, kindly given to me by Miss A. M. Buitendijk.

In the figures as published the galeal setae are not shown, but in the original they appear to be shown as ciliated. Oudemans states that the palpal claw is trifurcate, and that the setae on the palpal femur and genu are branched, but on the tibia only the ventral is branched. The posterior margin is angular with the side portions initially from PL slightly concave, thus the scutum is pentagonal. AM scutal seta reaches to just beyond the apex of the posterior scutal margin, and the sensillae bases are in the posterior half of the scutum and slightly behind line of PL. Oudemans quotes the dorsal setae as 8.8.6.6.4.4, but the modern reading of these, and as shown in his figures are 2.8.6.6.6.4.4 = 36. The ventral setae are, posterior of coxae III, 10.8.8.8.6.2 = 42. Tarsi of leg III bear a long nude seta.

These details agree with those British specimens which Richards (Parasitol. 1950, 40, (192), 105, 118) recently placed as his group I of *autumnalis* with the same characters (see under *autumnalis*). It seems probable therefore that Oudemans' *inopinatum* is a good species, and that Richards' specimens of his "first group" are the same. This is further supported by the fact that the nymph reared by Bruyant from the larvae diagnosed by him as *inopinatum,* but which Oudemans later regarded as *autumnalis* (*pusillum*), differs in a number of important points from the nymphs and adults of *autumnalis* as described very fully by recent workers, André, Richards, etc., and as observed and figured in this paper by myself.

From Oudemans' description and figures the essential features by which the nymph of *inopinatum* differs from *autumnalis* are:

The sensillary setae are nude and not ciliated. The front tarsi are only slightly longer than the metatarsi, 137μ and 123μ (in *autumnalis,* 180μ and 145μ); the front tarsi are ca. twice as long as high (2½ times in *autumnalis*). The dorsal setae are gradually increasing in size to 110μ posteriorly in both species, but in *inopinatum* they have fewer and longer, more outstanding, setules.

This species therefore appears to be valid, and occurs in Europe associated with the common "harvest mite" *N. autumnalis* Shaw. In the absence of eyes it will fall into Hirst's *Neotrombicula.*

TROMBICULA (NEOTROMBICULA) RARA (Walch 1924).

Trombicula rara Walch 1924, Tr. Vth. Bien. Cong. Far East. Assoc. Trop. Med., (Singapore 1923); Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 90; Sig Thor and Willmann 1947, Das Tierreich, Lfg. 71b, 283 (as larvae).

Plate 93, fig. G–L.

The nymphs of the species have been reared in some numbers by K. L. Cockings at Kuala Lumpur, from larvae from a pill-millipede, *Oniscomorpha* sp.

The following description is from a number of these nymphs kindly forwarded to me for study and description by Dr. J. R. Audy.

Nymph. Of typical *Trombicula* facies. Colour in life pale and yellowish (Audy states in litt. that some, reared from larvae from a skink and one on two from rats were dark red). Length to 975μ; width across propodosoma 520μ, across hysterosoma 650μ. Legs I 710μ long and stronger than the rest, II 410μ, III 455μ, IV 585μ. Crista elongate, to 202μ long (including epistome 31μ) with subposterior sensillary area furnished with a pair of very long, 154μ, fine filamentous, and apparently nude sensillae; epistome triangular or conical with dentate margin and setae to 42μ long. Eyes absent. Chelicerae 103μ long, and slender, indistinctly finely serrate on inner margin. Palpi normal, tibia with 2 accessory strong spines at base of claw. Tarsi of leg I 175μ long by 65μ high (ratio = 1·7 : 1·0), metatarsi I 117μ long (ratio length tarsi I to metatarsi 1 = 1·5 : 1·0). Dorsal setae on propodosoma, short 20μ, tapering with pectinations, on hysterosoma rather longer, and posteriorly curved apically and spathulate or clavate in dorsal view (in side view showing a thickening only), to 30μ long. Genitalia with 2 pairs of discs. No precoxal plates on tarsi I.

Remarks. As given in the key this species can be distinguished by the nude sensillae and spathulate posterior dorsal setae.

This species has also been reared by officers of the U.S.S.T.C. and a specimen or specimens of nymphs are in the collection of the Army Medical School at Washington.

TROMBICULA (NEOTROMBICULA) HASTATA (Gater 1932).

Trombicula hastata Gater 1932, Parasitology, 24.

Neoschöngastia hastata, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 110, (as larvae).

Plate 94, fig. A–D.

Description of Nymph. Of typical *Trombicula* facies. Colour in life ?. Length to 520μ, width across propodosoma 312μ, across hysterosoma 364μ. Crista linear, 98μ long, with subposterior diamond-shaped areola; sensillae long, to 103μ, apparently nude to tip, bases 36μ apart; epistome not seen. Eyes absent. Chelicerae with fine serrations on dorsal edge. Palpi fairly elongate, tibia with single claw and two strong accessory spines near base. Legs: I 450μ long and stronger than the others, II 300μ, III 312μ, IV 364μ; precoxal plates absent; tarsus I 112μ long by 64·4μ high, metatarsus I 75·6μ long; claws normal. Dorsal setae to 36μ long, fairly thick with strong outstanding setules, not greatly tapering. Genital discs 2 + 2.

Loc. Reared by Dr. Audy and his colleagues from larvae on *Rattus sabanus* and *R. whiteheadi* from Kepong Forest Reserve, Kuala Lumpur, March 1950.

Remarks. The nymphs are only separated from those of other species on rather intangible characters as given in the key.

TROMBICULA (NEOTROMBICULA) JAYEWICKREMEI sp. n.

Plate 94, fig. E–K.

Description of Nymph. Of typical *Trombicula* facies. Colour in spirit white. Length (newly emerged) to 780μ; width across propodosoma to 390μ, across hysterosoma 450μ. Crista linea, 140μ long, with diamond or oval-shaped sensillary area with dumb-bell shaped areola; sensillae filamentous, ca. 100μ long, with minute barbs on basal half, and a few long ciliations distally; sensillae bases 39μ apart. Eyes absent. Chelicerae with inner edge finely serrated Palpi slender; tibia with 2 strong spines at base of simple claw. Epistome rectangular with denticulate anterior margin concave medially, and 1 ciliated seta. Legs I 590μ long and stronger than rest, II 375μ, III 325μ, IV 422μ; tarsi I tapering, 118μ long by 42μ high, metatarsi I 62μ long. Sternum entire, precoxal plates not evident. Dorsal setae uniform, on hysterosoma to 30μ long on elongate peduncles situated in well defined pits; the setae terminate in a three-lobed club as figured, which is in side view about 3 times as wide as the stem; the stem carries strong setules which are longest around base of club; on the propodosoma the setae are slightly shorter, and merely thickened at the apex, not clubbed.

Remarks. The above description is from 10 nymphs reared from larvae from *Rattus rattus kandiyanus* from Nalanda, Ceylon, (Sept., 1944), and a nymph from larvae from the same host, from Embilipitiya, Ceylon (Nov., 1944). The nymphs were reared by Mr. S. H. Jayewickreme, after whom the species is named.

The nymph is remarkable for the form of the dorsal setae.

TROMBICULA (NEOTROMBICULA) CANESTRINII (Buffa 1899).

Trombidium canestrinii Buffa 1899, Atti Soc. Veneta Trent di Sci. Nat.

Trombicula canestrinii, Berl. 1912, Redia, 8, (1), 88; Sig Thor and Willmann, Das Tierreich, Lfg. 71b.

Thrombicula canestrinii André 1931, Arch. Zool. Ital., 1,358; 1932, Assoc. Franc. Adv. Sc., Brussels, 273.

Plate 94, fig. L–R.

This species was redescribed by Berlese (1912) from four specimens from the type locality, Cansiglio, Italy. This locality was alpine at an altitude of 1,000 metres. I am indebted to Dr. Marc André for a certain amount of undetermined material amongst which were three specimens which can be with certainty assigned to Buffa's species. One specimen was collected by Dr. F. Grandjean from moss at Vallombrosa, near Florence, Italy, May, 1934, and the other two by Dr. André from moss and vegetable debris at Mangaillard, France, 16th June, 1939. The following re-description is drawn up from Berlese's and my own observations on the above fresh material.

Adult. Colour white to light rose. Of typical *Trombicula* facies. Length to 1,350μ, width to 700μ. Crista 292μ long, linear with roughly diamond-shaped sensillary area and paired sensillae, 150μ long, with distal ciliations and their bases 97μ apart. Epistome conical but rather flattened and with fine denticulations and 1 ciliated seta. Eyes absent. Chelicerae with finely serrate inner edge. Palpi relatively slender; tibia with 3 accessory spines at base of claw and a fourth midway towards articulation of palpal tarsus. Sternum entire, as long as broad; no precoxal plates evident. Legs all shorter than body; tarsi I 3 times as long as high (3·5 Berlese), 312μ by 110μ, metatarsi I 260μ long. Dorsal setae long and slender with long ciliations, but not extending to tip; posterior setae to 350μ, with apical fifth or sixth spine-like, generally nude, but frequently with apical and subapical fibrils. Genital organ with 3 pairs of discs.

TROMBICULA (NEOTROMBICULA) CLAVICATA (André 1937).

Thrombicula clavicata André 1937, Bull. Mus. Nat. Hist., Nat., 2nd. Ser., 9, (5), 316.

Plate 95, fig. A–E.

This species was described from a single adult collected in the rotten stump of a vine by Dr. F. Grandjean at Banyuls-sur-Mer, France, May, 1935.

The following description is abridged from that of André:

Adult. Colour white, with the general facies of *Trombicula.* Length 1,020μ, width 640μ on propodosoma, 600μ on hysterosoma. Crista 227μ long, linear, with rounded subposterior sensillary area, with paired filamentous sensillae which have minute barbs proximally and somewhat longer ones distally. Epistome rectangular with fine denticles and I short seta. Eyes absent. Palpi slender; tibia with 3 accessory spines at base of claw and a fourth more basad. Legs all shorter than body; I 850μ long, tarsi almost three times (2·8) as long as high, 210μ by 75μ; metatarsi I 140μ long. Body furnished with dense setae which are ciliated and apically terminated in a hyaline knob; length of dorsal setae varying from 22μ anteriorly to 70μ posteriorly. Genitalia with 3 pairs of discs.

Remarks. Through the great kindness of Dr. Marc André, I have been privileged to examine the type of *clavicata,* and can add the following data. The crista to the base of the epistome measures 195μ in length. The sensillae are 130μ long, ciliated for their whole length, with the ciliations basally very short but lengthening distally. The sensillae bases are 35μ apart. The sternum is entire, and there are no precoxal plates evident.

The figures here given are after André, but redrawn from the type.

TROMBICULA (NEOTROMBICULA) FORMICARUM (Berlese 1910).

Trombicula formicarum Berlese 1910, Redia, 6, (2), 369; *idem* 1912, Redia, 8, (1), 90; André 1931, Archiv. Zool. Ital., 16, 1,358; *idem* 1932, Assoc. France Adv. Sci., Brussels, 273; Sig Thor and Willmann 1947, Das Tierreich, Lfg., 71b.

Plate 95, fig. H–J.

This little known species has been recorded from Holland (Wasmann), Bavaria (Kneissl) and France (André). It was originally described from Holland from the nest of an ant *Lasius mixtus.*

No re-descriptions, since Berlese 1912, have apparently been published and the following details are from Berlese's work:

Adult. Colour white. Length 1,900μ, width 1,000μ. Eyes absent or vestigial. Palpi slender, tibia with 3 accessory spines at base of claw. Tarsi of leg I nearly 5 times longer than wide, 470μ by 100μ, metatarsi 360μ long. Dorsal setae with moderately short setae to the tip; from 40 to 50μ long anteriorly, increasing to 110μ posteriorly.

TROMBICULA (NEOTROMBICULA) CAMILLA (Wharton 1938).

Trombicula camilla Wharton, 1938. Fauna of the Caves of Yucatan, X, Acarina. Carnegie Inst. of Washington, No. 491, p. 141, fig. 1–3.

Plate 96, fig. A–F.

This species is remarkable for the very long front legs with their elongate tarsi. In the figures given here, those of Wharton 1938 have been reproduced with the addition of figures of the epistome, front tarsi and metatarsi and a dorsal seta, which have been recently supplied by Dr. Wharton. In the figure of the epistome from the specimens in Wharton's collection, two epistomal setae are shown. In a recent letter, however, Dr. Wharton informs me that in the type in the U.S.N.M., only one epistomal seta is present. Occasionally such an aberration occurs in other adult species of Trombiculidae but here the epistome itself is hyaline, and denticulate as in the Trombiculidae, and not as in the *Leeuwenhoekiidae,* where two epistomal setae are characteristic.

The description as given by Wharton, with additional data is as follows:

"*Adult.* Large size, length 3·5 mm., width 2·2 mm. Palpi extend to the third segment of the first pair of legs; palpal claw strong, half as long as the penultimate segment which bears it; accessory spines four, curved, subequal, forming a comb; palpal thumb not swollen. Chelicerae slender; chelae short and slender, extending beyond second joints of palpi. Crista rod-like expanded at anterior end and fringed as a rounded conical denticulate membrane, and with one seta (*occasionally two*); expanded at posterior end into a diamond-shaped pseudostigmatic area behind which it ends in two strongly diverging lateral arms. Pseudostigmata small, situated at lateral angles of pseudostigmatic area; pseudostigmatic organs long and setiform and nude. Eyes absent. Abdomen 2·5 mm. long; 2·2 mm. wide; setae moderate, barbed, posteriorly to 260μ. Genital opening 0·5 mm. long, anterior end between hind coxae. Genital armature consists of a spathulate plate smaller than the genital opening with a

small shovel-shaped plate at base. Anal opening 0·2 mm. long, 0·2 mm. behind the posterior edge of the genital plate. Anterior legs slightly longer than posterior, about 2·5 mm. long; front tarsi elongate, ca. 8½ times as long as wide, ca. 950μ by 110μ, metatarsi 700μ. Tarsal claws simple, those on first leg small and subequal, those of the other legs larger and unequal."

Type loc. Oxolodt Cave, Yucatan.

Type specimen. U.S.N.M. No. 1,263.

TROMBICULA (NEOTROMBICULA) SPICEA (Gater 1932).

Trombicula spicea Gater 1932, Parasitol., 24, 143–174; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 76 (as larvae).

Plate 96, fig. G–L.

The nymphs of this species have been reared from larvae from the ears of *Rattus r. kandiyanus* from Embilipitiya, Ceylon, by Mr. S. H. Jayewickreme, to whom I am indebted for material and the opportunity of describing the nymph. The identity of the larva which has not been recorded from anywhere since Gater's original description and record of the species from Selangor, F.M.S., has been checked against two of Gater's paratypes, and the association of the larvae with the nymphs has been checked by examination of the larval pelts.

In Ceylon the larvae of this species were associated with *Schöngastia* (*Asco-schöngastia*) *indica* Hirst, as was also recorded by Gater for his Malayan material.

Description of Nymph. Of typical Trombicula facies, but somewhat slender. Colour in life? Length (freshly emerged) 650μ, width across propodosoma 273μ, across hysterosoma 273μ. Crista linear, 112μ long, with broad somewhat diamond-shaped sensillary area, furnished with a pair of long, 98μ, uniformly thick sensillae which are barbed in basal part, and shortly ciliated distally; sensillae bases 36μ apart; just anterior of sensillary area and on each sider of anterior rod is a long strongly ciliated seta, much longer (31μ) than the surrounding stae. Epistome rounded-conical with strong denticles and 1 ciliated seta 22μ long. Chelicerae finely serrated on inner margin. Palpi slender, tibial claw with 2 accessory spines. Eyes absent. Legs I longer and stronger than rest, 495μ long, II and III 285μ, IV 365μ; tarsi I 97μ long by 45μ high, metatarsi I 84μ long. Sternum entire, undivided. No precoxal plates. Dorsal setae of two distinct sizes, anteriorly 14μ long, posteriorly 40μ long, tapering, with outstanding setules. Genital discs 2 pairs.

TROMBICULA (NEOTROMBICULA) (? RUSSICA Ouds. 1902).

Larvae.

Trombidium (*Otonyssus*) *aurantiacum* Ouds. 1897, (*non.* Kolenati), Tijds. Entom., 40, 118.

Thrombidium russicum Ouds. 1902, Entom., Ber., 1, (7), 43; 1903, Tijds., Entom., 45, 142–143, tab. 12, fig. 39–42; *idem* 1903, *ibid.* 46, 5; *idem* 1909, *ibid.* 52, 31, tab. 7, fig. 31–36.

Allothrombidium russicum Ouds. 1906, Entom. Ber., 2, (29), 87.

Allothrombidium muscae Ouds. 1906, Entom. Ber., 2, 43.

Thrombidium muscae Ouds. 1909, Tijds. Entom., 52, 35, tab. 6, fig. 26–30.

Trombidium (*Heterothrombidium*) *muscae* Verdun, 1909, C.R. Soc. Biol. Paris, 67, 246; *ibid.*, 67, 246.

Microthrombidium muscae Ouds. 1909, Entom. Ber., 3, (50), 20.

Microthrombidium russicum Ouds. 1909, Entom. Ber., 3, (50), 20; *idem* 1910, *ibid.*, 3, (52), 47; *idem* 1912, Zool. Jahrb., Suppl. 14, 5.

Adult.

Trombicula russica Vitzthum 1932, in Zool. Jahrb., Suppl. 63, 687–690; Sig Thor and Willmann 1947, Das Tierreich, Lfg. 71b, 345.

The adult of a species under the name of *russica* was briefly described by Vitzthum. The description as translated from Sig Thor and Willmann, 1947, is as follows:

"Colour pale yellowish, almost white. Eyes absent completely. Body hairs as in *autumnalis* but not much longer posteriorly as in that species, from 62–65μ. Length of ♀ 1,200μ.

From the Lutherothgrotte of St. Canzian Caves near Trieste. Coprophilous in bat guano."

Remarks. As Oudemans has synonymized his *muscae* and *russica*, two species which from his description and figures as published in 1909 (Tijds. Entom. 52) are obviously quite distinct, it is somewhat uncertain to which larvae Vitzthum's adult must be related.

TROMBICULA (NEOTROMBICULA) FORDI sp. n. Lawrence, T. J.

See Larval Section of this paper.

Plate 96, fig. M–Q.

Through the kindness of Lt. Col. Audy I have been privileged to study four nymphs reared from larvae of this species in Burma by Mr. K. L. Cock-

ings. The larvae were from *Rattus rattus brunneusculus* from Imphal. 20/12/45.

Description of Nymph. Size fairly large. Facies as in typical *Trombicula*. Length (newly emerged) 640μ; width across propodosoma 355μ, across hysterosoma 385μ. Crista elongate with subposterior sensillary area, 102μ long excluding epistome, with epistome 115μ; epistome rounded-conical with dentate margin, and 1 ciliated seta. Sensillae fine and filamentous, with minute barbs basally and short ciliations distally, to 60μ long and bases 29μ apart. Chelicerae with inner margin indistinctly serrate. Eyes absent. Palpal claw with 2 accessory spines at base and a nude spine on outer side; tarsi with 4 nude apical spines. Legs I longer and stronger than the others 420μ, II 280μ, III 280μ, IV 325μ; tarsi I 108μ long by 51μ high, metatarsi 64μ long. Dorsal setae, anteriorly 25μ pectinate and normal, posteriorly and generally interspersed to 45μ, with parallel sides which at the extreme tip expand into a small roughly oval tip, furnished with strong setules (see figure). Genital discs two pairs.

Remarks. Characterized mainly on the peculiar dorsal setae and as in the key.

TROMBICULA (NEOTROMBICULA) SARCINA (Womersley 1944).

Trombicula sarcina Womersley 1944, Tr. Roy. Soc. S. Austr., 68, (1), 95, (larvae).

Plate 97, fig. A–F.

This species has been reared to the nymph by Mr. D. A. Gill from larvae collected from sheep at Clermont, Queensland in Dec. 1944. The following description is from three of these nymphs kindly sent to me for study by Mr. Gill.

Nymph. Length to 660μ; width across propodosoma 430μ, across hysterosoma 470μ. Colour in life reddish. Crista as in the genus, 105μ long, sensillae with a few (3 to 4) ciliations distally, filamentous, ca. 100μ long, with bases 33μ apart; ratio crista length to SB = 3·2 : 1·0. Palpal tibia with only two accessory spines at base of claw. Epistome rounded, or subtriangular with fine denticulations and 1 ciliated seta. Chelicerae finely serrated on inner edge. Eyes absent. Legs all much shorter than body, with I the longest and strongest; I 460μ long, II 290μ, III 320μ, IV 370μ; tarsi I 114μ long by 57μ high, ratio 2·0 : 1·0; metatarsi I 83μ long, ratio length tarsi to metatarsi = 1·37 : 1·0. Sternum entire, no precoxal plates on leg I. Dorsal setae short, with long outstanding setules varying from 20μ anteriorly to 40μ posteriorly.

TROMBICULA (NEOTROMBICULA) MOESICA (André 1932).

Thrombicula canestrinii v. *moesica* André 1932, Assoc. France Adv. Sci., Brussels, 273; 1937, Bull. Mus. Nat. Hist. Nat., 2nd ser., 9, (5), 313.

Trombicula moesica, Sig Thor and Willmann 1947, Das Tierreich, Lfg. 71b.

Plate 97, fig. G–J.

This species was described from a single adult female collected by R. M. Remy in the Gradje Cave, Yugoslavia, August 1930.

Through the great kindness of my colleague Dr. M. André I have been able to examine this unique specimen and the following re-description is from that of André and my own observations.

Adult ♀. Colour white. Of typical *Trombicula* facies. Length 1,420μ, width 780μ. Crista 227μ long, with a more or less diamond-shaped sensillary area, with paired filamentous sensillae, 260μ long and with 3–4 long fine branches distally. Sensillae bases 78μ apart. Epistome 58μ deep, rounded-conical with strong denticulations and one seta to 65μ long and ciliated. Eyes absent. Chelicerae on inner (dorsal) edge finely serrated. Palpi slender; tibia with 3 accessory spines at base of claw (only 2 shown in André's figure) and a fourth midway between base of claw and articulation of palpal tarsus. Tarsi of leg I 305μ long by 91μ high; metatarsi 227μ long. Dorsal setae uniformly thick, ciliated to tip, anteriorly 45μ long, posteriorly 97μ. Genitalia with 3 pairs of discs. Sternum entire; no precoxal plates evident.

Remarks. André compared his species with the three adult European species of *Trombicula* then known, viz. *canestrinii* Buffa 1899, *formicarum* Berl. 1910 and *autumnalis* (Shaw 1790), particularly in regard to the relative length and height of the first tarsi, and the lengths of the dorsal setae. On the close agreement of the proportionate length to height of the front tarsi, 3·5 in *canestrinii,* he regards his species as a variety of this species. Apart from the very slight difference in the front tarsi there is a much more obvious and important difference in the structure of the dorsal setae. In *canestrinii* as figured by Berlese, the dorsal setae and particularly the posterior setae are very much longer and the apical fifth or sixth is shown as nude and spine-like. In the specimens of *canestrinii* which I have been able to study, this is the general appearance under medium magnification; under higher magnification however, many of them show that the extreme part of the spine-like tip is itself fibrillated. In *moesica* besides being shorter, the dorsal setae have fairly long setules extending right to the tip.

TROMBICULA (NEOTROMBICULA) AUTUMNALIS (Shaw 1790).

Acarus autumnalis Shaw 1790, Nat. Misc., 2, 42.

Leptus autumnalis, Brandis 1897, Festschr. d. Provinzial Irrenasstalt, Nietleben; Bruyant 1910, Zool. Anz., 35, 347–352; Picard 1927, Bull. Soc. Zool. France, 52.

Microtrombidium autumnalis, Oudemans 1912, Zool. Jahrb. Suppl., 14; *idem* 1913, Acarol. Maulwerfnestern, Archiv. Naturgesch., (9), 127 (these probably refer to *inopinatum* Ouds. 1909).

Trombicula autumnalis, Hirst 1926 (*Neotrombicula*), Ann. App. Biol., 13, 140–143; André 1929, (*Thrombicula*), Bull. Soc. Zool. France, 54; *idem* 1929, Bull. Mus. Nat. Hist. Nat., 2nd ser., 1; *idem* 1930, Mem. Soc. Zool. France; *idem* 1931, Archiv. Zool. Ital., 16; *idem* 1937, Bull. Mus. Nat. Hist. Nat., 2nd ser., 9, 313; Warburton 1928, Parasitology, 20, 228–236; Sig Thor and Willmann 1947, Das Tierreich, Lfg., 71b.

Plate 98, fig. A–G.

The first attempt to rear the nymph of this species from the larvae appears to be that of Brandis 1897. The nymph obtained was, on account of its thick coating of hairs, considered as that of *Trombidium holosericium.* Bruyant 1910 also succeeded in obtaining a single nymph, which was regarded as *Microtrombidium pusillum* Herm. by Oudemans 1912. In 1913, however, Oudemans on re-examination of the specimen showed that it differed from *Microtrombidium pusillum* in the structure of the front tarsi, palpi and dorsal setae. He regarded it as distinct and referred it to *Microtrombidium autumnalis* (Shaw). In 1916, Zool. Anz., 46, 253, Kneissl obtained nymphs from larvae identified as *T. inopinatum* Ouds. 1909 (a species the larvae of which are generally regarded as conspecific with *autumnalis* (Shaw). He recognized these nymphs as belonging to the genus *Trombicula* Berl. 1904 and unhesitatingly referred the nymph reared by Bruyant and figured by Oudemans 1913 to *autumnalis.* Stanley Hirst 1926 also bred a nymph from larvae identified as *Leptus autumnalis* which he showed belonged to *Trombicula* Berl., and designated this species as the type of a new subgenus *Neotrombicula.*

Our most complete study of the nymph and adult of this species is that of Marc André (1930), and at the present time *autumnalis* is probably the best known and described species, from all stages. The following re-descriptions of the adult and nymph are mainly from André's studies, supplemented or

checked by my own observations on British material, obtained while in London in 1947 from Dr. W. S. Richards.

Re-description of Nymph. Facies of *Trombicula* but rather elongate with the hysterosoma narrower than the propodosoma. Length 930μ, width of hysterosoma to 310μ (after André). Colour in life, pale to light yellowish. Crista linear, with a subposterior diamond-shaped sensillary area; with paired filamentous sensillae each with 5 or 6 distal setules. Epistome somewhat triangular, with denticulations, and 1 long ciliated seta. Eyes absent. Chelicerae with inner edge finely serrated. Palpi moderately stout; tibia with 2 accessory spines at base of claw. Legs all shorter than body, I the longest and strongest, with tarsi I 180μ long by 70μ high (André), metatarsi 145μ long. Dorsal setae ciliated to tip, 30μ long anteriorly, increasing to 110μ posteriorly (André). Sternum entire, roughly pentagonal and as long as wide; no precoxal plates evident. Genital orifice with 2 pairs of discs.

Re-description of Adult. As in nymph in shape. Length to 2,050μ, width across hysterosoma to 850μ. Colour white to light yellow. Crista, sensillary area, sensillae and epistome as in nymph. Eyes absent. Palpi as in nymph but with 3 accessory spines at base of tibial claw. Legs as in nymph. Dorsal setae as in nymph. Genital organ with 3 pairs of discs. Sternum as in nymph; no precoxal plates present.

Remarks. W. S. Richards has recently (Parasitology, 1950, 40, (12), 105, and 118) published two very important papers on the variation in the larvae, and on the distribution and biology of the European harvest-mite in Britain. In the first he shows that very considerable variation occurs in morphological characters of the larvae regarded as this species, such as: (1) the ciliated or nude galeal setae and the dorsal and lateral setae on the palpal tibia, (2) the duplication or otherwise of some of the scutal setae, (3) the lengths of the scutal setae, (4) the number and arrangement of the humeral and dorsal setae, and (5) the Standard Data of the scutum. Despite all these variations, he is inclined to the view that all the larvae he studied are to be referred to the one species *Trombicula autumnalis* (Shaw).

In my experience, some of the variations suggest that at least two species occur in Britain. Dealing with the variations, the occasional (apparently more frequent in Britain) duplication of one or more of the scutal setae is to be found in many species of Trombiculidae, and is a teratological occurrence of no taxonomic value, provided that it is recognized for what it really is. For example, the occasional occurrence of 2 AL in a Trombiculid specimen is not to be confused with the 2 AM in a Leeuwenhoekiid. Similarly the occurrence of

2 humeral setae on each side may only be a freak variation and of no specific importance.

The specimens with ciliated or branched galeal and dorsal and lateral palpal setae together with dorsal setae 2.8.6.+, with a total of 36, seem to suggest the species *T. inopinatum* rather than true *autumnalis*. The larvae of *T. inopinatum* was described in 1909 (Tijds. v. Entom., 52, 43, tab. 7, fig. 37–40, Ouds.). In Oudemans' original drawing No. 1,105, in the Leiden Museum, for a photostat of which I am indebted to Miss A. M. Buitendijk, are given figures of the nymph reared from Bruyant's larva, and labelled as *Microtrombidium inopinatum* Ouds.

The nymph as thus figured by Oudemans (these figures were published 1913 Acarologisches aus Maulwurfnestern, Arch. Naturg., LXXIX—A, taf. XII, fig. 1–6) under the name of *Microtrombidium autumnalis* (Shaw) does not coincide with the details of *autumnalis* as delineated by recent students, André, Richards, and myself herein. In particular, the sensillae are shown and stated to be nude, whereas in *autumnalis* they are ciliated. The dorsal setae although of one kind, and gradually lengthening posteriorly are more sparsely beset with longer setules; they reach posteriorly, however, to approximately the same length of 100–110μ. (In W. S. Richards' first paper, *loc. cit.*, in a footnote, he gives the mean length of the posterior setae in two lots of adults as $10{\cdot}5\pm0{\cdot}86$, and $9{\cdot}7\pm1{\cdot}52\mu$. This is probably an error for in some of his English material which I have examined, these setae are up to 100μ as given by André *et al.*). It would seem then that some of Richards' larval material might possibly be referred to Oudemans' *inopinatum* which is probably a good species, distinguishable in both larvae and adults from *autumnalis*. Richards was not very successful in rearing nymphs and those which he obtained appear to conform to typical *autumnalis*. The metatarsi of leg I in the nymph of *inopinatum* as figured by Oudemans are very little shorter than the tarsi, 123μ to 137μ, whereas in *autumnalis*, the lengths are 195μ and 260μ respectively.

Richards unquestionably had adults of both sexes of *autumnalis* but in his figure of the male (fig. 22) he has omitted and probably failed to observe the pair of specialized titillating setae on each side of the penis opening.

Whether the specimens with *autumnalis* type of galeal and palpal tibial setae but with 2.8.6.+, and more than 32 dorsal setae are only variations of this species or should be referred to something else must, as also with *inopinatum*, await further and more detailed work on the lines of rearing larvae from known adult females. Richards' second paper on the "Distribution and Biology of the Harvest Mite" also suggests that the two major forms (with and without galeal setae etc. ciliated) occur at different seasons and in different

climatic areas although some overlapping occurs, e.g. the *inopinatum* form was not met with north of Oxford, whereas the typical, and its variations occurred throughout England and in Scotland.

TROMBICULA (NEOTROMBICULA) COARCTATA (Berlese 1888).

Trombidium coarctatum Berlese 1888, Acari Austro-americani Bull. Soc. entom. Ital., 20, 179, pl. 5, fig. 5; *idem* 1893, A.M.S., Prost., 98; Berlese and Leonardi 1902, Zool. Anz., 25, 17.

Trombicula coarctata, Berlese 1912, Redia, 8, (1), 91–92, fig. 42; *non* Kitashima and Miyajima 1918, Kitasato Archiv. Exper. Med., 2, 190–191, pl. 8, fig. 1; *non* Ewing 1920, Ann. Entom. Soc. Amer., 13, 382–389; *non* Ewing 1926, Entom. News, 37, 111; Ewing 1931, Proc. U.S.N. Mus., 80, 7, (in part); *non* Ewing 1933, Proc. U.S.N. Mus., 82, 2; Sig Thor and Willmann 1947, Das Tierreich, Lfg. 71b, *non* fig. 416.

Plate 95, fig. K–L.

This species was originally described by Berlese from two specimens from under stones, one from Buenos Aires, and one from Rio Apa (Paraguay). It was later (1902) recorded by Berlese and Leonardi from Chili. Since then however, no authentic material appears to have been seen and studied.

The following description is a compilation from Berlese's original paper and his later notes of 1912.

Nymph. Colour white. As in typical *Trombicula* with a constriction between second and third pairs of legs; shoulders well rounded. Eyes absent. Crista linear with subposterior sensillary area about as wide as long. Sensillae ? (probably filamentous). Palpi slender, tibial claw with 2 accessory spines at base (hence Berlese's specimens would be nymphs); tarsus elongate clavate. Legs slender and short; posterior hardly reaching beyond abdomen; tarsi I widest basally, apex subacute, subtriangular; tarsi I 180μ long by 75μ high, metatarsi I 130μ long. Body densely covered with setae, which are only slightly tapering, to 70μ long posteriorly and with outstanding ciliations. Length to 1,150μ, width to 850μ.

Remarks. In 1918 Kitashima and Miyajima considered that the adults of the Japanese "kedani" mite were conspecific with the S. American species. Ewing (1920) reported having, along with Miyajima, studied Japanese specimens and compared them with the American species, *splendens* Ewing and *cinnabarinus* Ewing (= *alfreddugesii* Ouds.). They also concluded that *coarctata* and the Japanese material were the same species, and published a redescription and figures of *coarctata* based on Japanese specimens.

Apart from the very widely different geographical localities, there are however, certain subtle differences to be found between the descriptions and figures of Berlese, and those of Kitashima and Miyajima, and of Ewing.

Berlese gives the colour as "white" whereas the Japanese species according to Kitashima and Miyajima is "light reddish colour." Another important specific difference is seen when we compare the figures of the dorsal setae. Berlese shows them as slightly tapering with relatively few outstanding setules. In Ewing's figure, the setae are heavily ciliated and somewhat bushy towards the tip. In *coarctata* Berlese the posterior dorsal setae reach to 70μ in length. Ewing gives no dimensions for the Japanese specimens. Again, although the front tarsi are closely similar, those of the Japanese form are somewhat longer, 2·5, in proportion to height, than the ratio of a 2·4 given by Berlese. The structure of the epistome was not studied or delineated by earlier workers, but Ewing figures it for Miyajima's material as rectangular with anterior edge straight. Although this form of epistome is not unknown in the Trombiculidae, it is unusual; the genral form is rounded-conical. Berlese did not stress or describe the sensillae of the S. American species.

Unquestionably then the Japanese material was not con-specific with *coarctata* Berl. but was probably identical with *akamushi* Brumpt.

TROMBICULA (NEOTROMBICULA) CAVERNARUM (Ewing 1933).

Trombicula cavernarum Ewing 1933, Proc. U.S. Nat. Mus., 82, (29), 4.

Plate 95, fig. F–G.

This species was described from two males and one female from Chilibrillo Caves, Panama.

The original description is as follows:

"*Adult.* Moderate in size and of the shape typical of the genus. No capitulum present. Palpi reaching beyond the middle of the first patellae; palpal claw weak, but little over half as long as the arched segment which bears it; accessory spines four, subequal, forming a comb; palpal thumb slightly swollen and extending to middle of palpal claw. Chelicerae very slender; chelae slender, sharp, tips extending slightly beyond the tips of second palpal segments. Crista rod-like, expanded near its posterior end into a diamond-shaped pseudostigmatic area slightly beyond which the crista ends in two strongly diverging lateral arms. Pseudostigmata moderate, situated near lateral angles of pseudostigmatic area; pseudostigmatic organs very long, setiform, with two barbs. Eyes absent. Abdomen about one and a half times as long as broad;

setae short for the genus. Genital opening about one-half of its diameter from posterior coxae. Genital armature of male composed of a basal plate, a protruding penis, and an inwardly projecting manubrium; basal plate horse-shoe-shaped; penis a cone-shaped, sclerotized structure, situated between the two arms of the basal plate; manubrium somewhat longer than penis and arising from base of same. Anus somewhat smaller than genital opening and situated about one and a half times its greatest diameter behind the same. Anterior legs only slightly larger than posterior. Tarsal claws all simple, those of the first legs quite small and subequal, those of the other legs unequal, the posterior claw being larger than the anterior. Length, 1·12 mm.; width 0·7 mm."

Remarks. No dimensions other than total length and width are given, and it is very difficult to compare this species with others from what data is available. In the absence of eyes and the structure of the sternum it belongs to the subgenus *Neotrombicula,* and on the proportions of the front tarsi and metatarsi is close to *formicarum* Berl. and *camilla* Wharton.

TROMBICULA (NEOTROMBICULA) MANRIQUEI (Ewing 1937).

Trombicula manriquei Ewing 1937, Proc. Biol. Soc. Washington, 50, 169; Sig Thor and Willmann 1947, Das Tierreich, Lfg. 71b, 353.

This species is as yet, only known from a single specimen, described by Ewing, and collected from humus in a tree hole at Villavicencio (Quenane) Meta Department, Colombia. Type in U.S.N.M.

Ewing's description is as follows:

"Palpus slender, extending about one-half its length beyond chelicerae. Palpal thumb slender, well clothed with setae and slightly surpassing tip of palpal claw; palpal claw rather slender without tooth, moderately curved; accessory spines three, subequal, arranged in a comb. Crista extending forward as a pointed rod between bases of chelicerae and expanded posteriorly into a laterally rounded pseudostigmatic area, the latter without posterior lobes. Pseudostigmatic organs simple, flagelliform, longer than crista. Eyes absent. Abdomen densely beset with tapering barbed setae which increase progressively in length from anterior to posterior border. Anterior legs longest; posterior next in length; legs of second and third pairs subequal. Claws on tarsi I unequal, also those on tarsus IV unequal; those on tarsus II subequal, and on tarsus III subequal.

"Length of body 0·96 mm.; greatest width 0·53 mm."

Remarks. Ewing states, "Although this specimen is small for an adult of the genus *Trombicula,* the presence of three accessory spines near the base of

the palpal claw and of three pairs of genital suckers surrounding the genital opening indicates it is an adult. This species is nearest *T. coarctata* Berlese and *T. splendens* Ewing, from both of which it differs in having no posterior lobes to the pseudostigmatic area."

TROMBICULA (NEOTROMBICULA) GOLDII (Oudemans 1910).

Microtrombidium goldii Oudemans 1910, Entom. Ber. Nederl. Ver., 3, 84; *idem* 1912, Zool. Jahrbs. Suppl. 14, 13–15 (larva).

Trombicula goldii Ewing 1931, Proc. U.S.N. Mus., 80, 7 (larva).

Trombicula (*Eutrombicula*) *goldii,* Sig Thor and Willmann 1947, Das Tierreich, Lfg. 71b, 279 (larva).

Trombicula goldii, Boshell and Kerr 1942, Riv. Acad. Columbiano Cien. Exact. Fisic. Nat., 5, 112; Michener 1946, Ann. Ent. Soc. Amer., 39, (1), 101–118 (adult).

Plate 95, fig. M.

This species, in the adult stage is only known from Colombia, S. America, where it is apparently fairly common.

A translation of Boshell and Kerr's description is as follows:

Adult. Size small with pronounced constriction between abdomen and cephalothorax; colour carmine; legs much shorter than body; anterior legs much thicker than others. Palpi long and stout, reaching to base of patella of leg I; segment II widened; claw of palpi strong and simple, two-thirds length of fourth segment; a row of 3 unequal spines on small protuberance at base of claw. Thumb of palpi wide, lightly clavate and reaching tip (of claw); furnished with pectinate setae. Mandibula apophysis (chela) strong, sickle-shaped, with finely serrate concave edge. Eyes absent. Crista well developed, rod-like anteriorly with a wide triangular subposterior area with two pseudostigmata in the posterior lateral angles. Pseudostigmatic organs flagelliform, long, with some small ciliations on distal third. Dorsal setae of one type, dense, but longer posteriorly than on shoulders; situated on elevated discs, ending in a point and ciliated. On the dorsal surface, postero-lateral of the anus, one finds a pair of areas, refractive, somewhat in relief and resembling eyes. Genital aperture dimorphic and easy to see in cleared or partially cleared specimens. The female has a pair of peculiar cup-like structures, approximately half the diameter of the genital discs, and surpassing the posterior pair of discs. The males have an ovoid structure without precise details, approximately twice the size of the genital discs and placed in the middle of these. Leg I approximately twice as thick as IV; I and IV about equally long, II and III distinctly shorter than IV. Tarsi I not wider (higher) than patella I,

symmetrical, conical, with the distal diameter a little less than half the basal diameter. Tarsi I approximately 1·4 times as long as the patella; other segments about equal. The other tarsi relatively longer and more slender with extremities truncate. Each tarsus with a pair of equal, slender and curved claws; those on tarsi I about half the size of the others.

Localities. Restrepo, Villvicencio (Meta) at 400–900 metres; Municipality of Bolivar (Santanda) at 500–1,000 metres; Municipality of Muzo (Boyaca) at 700–1,000 metres. Found in humus, tree holes and under bark of fallen logs, at all seasons of the year.

The captured adults were correlated with a nymph and adult reared in the laboratory.

Remarks. There is no doubt that this is a true Trombiculid despite the author's statement "with pronounced constriction between cephalothorax and abdomen"; this is surely meant to refer to the usual constriction between the second and third pairs of legs.

The author's description of the difference in the genitalia of the two sexes is interesting and important but would be better understood if figures had been given.

TROMBICULA (NEOTROMBICULA) sp. n. (Cooreman *in litt.*).

Plate 98, fig. N–O.

In 1947, on a visit to the Musee Röyal D'Histoire Nat. de Belgique, Bruxelles, my friend Dr. J. Cooreman drew my attention to a single specimen of an adult *Trombicula* which he had collected from a "microcaverne endoxyle" in *Ulmus campestris* at Boitsfort, near Bruxelles, March 25, 1947. At the time it was thought that it might be *Trombicula inopinatum* Ouds., but our examinations of the specimen shows that it is probably a new species, which Dr. Cooreman will be duly describing.

In the meantime I am greatly indebted to Dr. Cooreman for the following details and figures which will enable the species to be separated from others.

Length 720μ, width 380μ. Of typical *Trombicula* facies. Eyes absent. Crista 150μ long, with triangular dentate epistome, with smooth epistomal seta; sensillae long and fine, with sparse barbs distally. Legs: I 420μ long, II 250μ, III 240μ, IV 325μ; tarsi I 115μ long, ? wide, metatarsi I 100μ long. Dorsal setae figured, anteriorly 20–30μ, posteriorly 40μ.

Remarks. The species is close to *sarcina* Wom. from Australia, but differs in the smooth epistomal seta and the relative lengths of front tarsi and metatarsi. In the smooth epistomal seta and shorter posterior dorsal setae it differs from both *autumnalis* and *inopinatum*, while the distally barbed sensillae separates it from *inopinatum*.

TROMBICULA (NEOTROMBICULA) HARRISONI sp. n.

Plate 113, fig. A–E.

Description of Nymph. Of typical *Trombicula* facies. Length 355μ; width across propodosoma 195μ, across hysterosoma 225μ. Crista elongate, length including epistome 112μ; subposterior sensillary area as figured, with SB 31μ; sensillae filamentous, but rather thickened medially, to 90μ, with short ciliations on distal four-fifths; epistome rounded-conical, dentate, with ciliated seta 20μ long. Eyes absent. Chelicerae strongly serrate on inner edge. Palpi rather slender; tibia with two accessory spines at base of claw. Dorsal setae from 10–14μ long anteriorly, lengthening to 34μ posteriorly; anterior setae tapering with outstanding setules, posteriorly more parallel sided almost to tip. Leg I slightly longer than body, to 375μ, II and III 195μ, IV 225μ; tarsi of leg I 84μ long by 42μ high, metatarsi I 84μ long.

Loc. The type nymph is one reared by the British Scrub-typhus Research Team, in Malaya from larvae of the new species *harrisoni,* from bats No. 11018, from Bukit Lagong Forest Reserve, Kepong, Malaya, 1950, and correlated with the larval pelt.

Remarks. As with most nymphs and adults of the Trombiculidae, specific separation from other species is based on rather intangible characters. An attempt to separate the above species has been made in the key. The larvae, however, is abundantly distinct.

Genus GUNTHERANA Womersley and Heaslip 1943.

Guntherana Womersley and Heaslip 1943. Trans. Roy. Soc. S. Austr., 67, (1), *nom. nov.* for *Guntheria* Womersley 1939, Rec. S. Aust. Mus., 6, (1), 157, preoc.

Genotype *Neoschöngastia kallipygos* Gunther 1939 (larva).

The nymphs and adults of this genus have not hitherto been described. In the present work the adult and nymphal stages of the genotype *Guntherana bipygalis* (Gunther 1939) are described and the genus defined for these stages. A second species from Kangaroo Island, South Australia, *G. tindalei* (Wom. 1946) known from a captured adult is now referred to the genus.

Diagnosis of Genus (from Adult or Nymph). Form as in the genus *Trombicula.* Crista linear with very widely transverse sensillary area, with a dumbbell-shaped areola, and shallow posterior angle, filamentous sensillae, and the anterior arm of the crista shorter than the distance between sensillae bases. Epistome anteriorly concave with fine denticles and 1 seta. Eyes absent. Pre-

coxal plates of leg I well defined, and barely touching in middle line so that there is no true sternum. Tarsi of leg I without any dorsal subapical process. Dorsal setae tapering, slender and ciliated.

Genotype *G. bipygalis* (Gunther 1939).

Key to the Adult and Nymphal Species.

1. Colour in life red. Dorsal setae fairly thick, to 70μ long posteriorly. Tarsi I less than twice as long as high. *G. bipygalis* (Gunther 1939).
   Colour in life white 2
2. Tarsi I ca. 2½ times as long as high. Dorsal setae rather fine, to 100μ long posteriorly. *G. tindalei* (Womersley 1946).
   Tarsi I twice as long as high. Dorsal setae much thicker, anteriorly on propodosoma to 13μ long, posteriorly on hysterosoma forming a conspicuous fringe with setae 65–70μ long. *G. translucens* (Womersley 1944).

GUNTHERANA BIPYGALIS (Gunther 1939).

Neoschöngastia callipygea Gunther 1938, *nom. nud.* Med. J. Aust., 2, (6), 202.

Neoschöngastia kallipygos, 1939, *nom. nud.* Derrick, Smith, Brown and Freeman, Med. J. Aust., Jan., 150.

Neoschöngastia kallipygos, 1939, Gunther, Proc. Linn. Soc. New South Wales, 64, (1–2), 83.

Neoschöngastia bipygalis 1939, Gunther, Proc. Linn. Soc. New South Wales, 64, (5–6), 471.

Guntheria kallipygos Womersley 1939, Tr. Roy. Soc. S. Austr., 63, (2), 157.

Guntherana bipygalis, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 132.

Guntherana parana Womersley 1944, Tr. Roy. Soc. S. Austr., 68, (1).

Plate 99, fig. A–F.

Description of Nymph. Of typical *Trombicula* facies. Colour in life reddish. Length 600μ, width across propodosoma 360μ, across hysterosoma 420μ. Crista linear with very wide, 101μ, and transverse sensillary area which has only a slight posterior angulation; sensillae bases 90μ apart, and the filamentous distally finely ciliated sensillae to ca. 150μ long. Apex of crista forked, epistome somewhat rectangular with the anterior margin concave and finely denticulate, with 1 seta. Eyes absent. Chelicerae finely serrate on inner margin. Palpi fairly stout, tibia with a pair of accessory spines at base of claw. Legs rather short, I the longest and strongest to 540μ long, II 390μ, III 390μ, IV 450μ;

tarsi I thick and slightly tapering, 144μ long by 90μ high, metatarsi I without any dorsal subapical process; both tarsi and metatarsi I with numerous slender sensory rods amidst the ciliated setae. Tarsal claws stout and unequal. Dorsal setae slightly tapering, from 36–75μ long, with outstanding ciliations. Genital discs 2 + 2.

Description of Adult ♀. Shape and colouration as in nymph. Length 1,200μ, width across propodosoma 630μ, across hysterosoma 750μ. Crista as in nymph but 180μ long, with sensillary area 158μ wide, and sensillae bases 136μ apart, sensillae ca. 200μ long, ciliated distally. Eyes absent. Chelicerae serrate on inner margin. Epistome as in nymph. Palpi with 3 accessory spines at base of claw, and another midway between base of claw and articulation of palpal tarsus. Precoxal plates of leg I as in nymph but more chitinized. Legs I 900μ, II 660μ, III 660μ, IV 930μ; tarsi I 240μ long by 130μ high; metatarsi I 130μ long. Dorsal setae as in nymph, 36–72μ. Genital discs 3 + 3.

Loc. The nymph is described from two specimens reared from larvae by Major G. M. Kohls, in New Guinea, 1944 (No. 253). A third and fourth nymph reared from larvae of what were thought to be *Ascoschöngastia womersleyi* Gunther, by Major Kohls (Dobodura, New Guinea, 11th May, 1944, No. 293) is really this species, and the identification of the larvae must have been in error.

The adult description is from a female from New Guinea, 1944 (G. M. Kohls No. 83) from which the larvae were obtained which were described by Womersley, 1944 as *Guntherana parana* n. sp. *G. parana* is now regarded as con-specific with *bipygalis*.

Remarks. The eggs of the larvae described as *parana* were not observed and no further information is therefore available as to their peculiar structure and location on the hairs of the host as described by Gunther 1939 (Proc. Linn. Soc. New South Wales, 64, (5–6), 471) for *bipygalis*.

GUNTHERANA TINDALEI (Womersley 1936).

Trombicula tindalei Womersley 1936, J. Linn. Soc. London (Zool.), 40, (269), 110.

Plate 99, fig. G–L.

Although the larva of this species is unknown the unique nymph is unhesitatingly placed in *Guntherana* on the characters of the very widely transverse sensillary area, the absence of any subapical process on the first tarsi, and the precoxal plates of leg I. It may be distinguished as given in the key, although it is certainly not very different from the genotype. A redescription of the nymph is as follows:

Re-description of Nymph. Shape as in typical *Trombicula.* Colour in life whitish. Length 1,180μ; width across propodosoma 400μ, across hysterosoma 700μ. Crista linear, 120μ, sensillary area broad 84μ with only a slight posterior angle, and paired filamentous sensillae 170μ long and distally with sparse outstanding ciliations; sensillae bases 75μ apart. Eyes absent. Chelicerae with finely serrate inner margin. Epistome somewhat rectangular, with the anterior margin lightly concave and denticulate; with 1 seta. Palpi slender, tibia with 2 stout accessory spines at base of the slender claw. Legs shorter than body, I thicker than II–IV; tarsi I tapering anteriorly, 140μ long by 58μ high, metatarsi I 85μ long; all tarsi with paired unequal claws; tarsi and metatarsi I with numerous slender rod-like setae in addition to the ciliated setae. Precoxal plates of leg I well chitinized, and barely conjoined medially, without a distinct sternum. Dorsal setae long, fine and slender, with outstanding ciliations, length from 30–100μ. Genital discs 2 pairs.

Loc. A single specimen from under a log at the Ravine, Flinders Chase, Kangaroo Island, South Australia, Dec., 1934 (N. B. Tindale).

Remarks. Upon remounting it is found that the transverse bar with 7 or 8 divisions described originally as lying at the posterior end of the crista, is not part of the crista, but probably some food-body lying within the gut. Remounting shows it not to be attached to the crista in any way, and it has now been moved in position.

GUNTHERANA TRANSLUCENS (Womersley 1944).

Trombicula translucens Womersley 1944, Tr. Roy. Soc. S. Austr., 68, (1), 83.

Plate 100, fig. A–F.

This species was described from two specimens from moss, from Mt. Arden, South Australia, collected by H. M. Cooper, 1943.

On the structure of the sensillary area it is now placed in *Guntherana.*

It is a rather characteristic species in that the longest dorsal setae form a very distinct posterior fringe. The colour in life is a translucent white.

The details of the species are as follows:

Adult. Length 850μ; width across propodosoma 425μ, across hysterosoma 510μ. Crista 109μ long, with triangular sensillary area with posterior apex; sensillae filamentous, to 75μ long, ciliated distally, their bases 50μ apart. Palpi with 3 accessory spines at base of tibia claw. Epistome transversely rectangular, with fine denticulation and 2 setae. Chelicerae finely serrate on inner margin. Eyes absent. Legs all shorter than body with I longer than others and tarsi I elongate and slightly tapering towards apex; 136μ long by 68μ high, ratio length to height = 2·0:1·0; metatarsus I 78μ long, ratio length tarsus I to

metatarsus I = 1·7 : 1·0. Dorsal setae strongly ciliated, tapering, on propodosoma 13μ long, on hysterosoma and anteriorly 13μ, posteriorly 65–70μ and forming a fringe. Precoxal plates of coxae I present.

Genus SCHONGASTIA Oudemans 1910.

Entom. Ber., 3, (54), 86–87; 1912, Zool. Jahrb., Suppl. 14.

Genotype *Thrombidium vandersandei* Ouds. 1905, Nova Guinea, 5, (larvae).

(Including *Ascoschöngastia* Ewing 1946, type *Neoschöngastia malayensis* Gater 1932).

Key to the Known Adult and/or Nymphal Species.

1. Sensillae distinctly but narrowly clavate or lanceolate 2

   Sensillae filamentous, but sometimes fairly but uniformly thick .. 5

2. Sensillae distinctly but narrowly clavate with short setules. Dorsally the posterior setae to 30μ with stout setules. Front tarsi 2½ times as long as high, and ca. half as long again as metatarsi. (Adult). *Schöngastia algerica* (André 1932).

   Sensillae narrowly clavate, but without distinct basal stem, gradually widening from base, and widest at ca. ⅓ from apex. Front tarsi ca. twice as long as high. Dorsal setae to 25μ posteriorly. *Schöngastia* (*Ascoschöngastia*) *audyi* sp. n.

   Sensillae lanceolate with a short thin basal stem, then thicker until near tip, where they taper 3

3. Front metatarsi small; slightly more than half the height of front tarsi. Sensillae fairly wide with moderately long ciliations. Dorsal setae uniform, pectinate, to 20μ. (Nymph). *Schöngastia* (*Ascoschöngastia*) *kohlsi* (Philip and Woodward 1946).

   Front metatarsi as high or almost as high as tarsi 4

4. In each angle in front of sensillary area a ciliated seta twice the length of neighbouring setae. Sensillae with fairly long setules. Tarsi I ca. twice as long as high and one-fourth again longer than metatarsi. Dorsal setae fairly uniform, to 30μ. (Adult). *Schöngastia* (*Ascoschöngastia*) *indica* Hirst 1915. (= *Trombicula muris* Walch 1932).

   No such seta in the angles in front of sensillary area. Stem of sensillae very fine and body not so wide as in *indica*. Tarsi I ca. two-thirds as long again as metatarsi, and rather more than twice as long as high. Dorsal setae uniform to 20μ. (Nymph). *Schöngastia* (*Ascoschöngastia*) *lanius* (Radford 1946).

5. Sensillae fine and nude 6

   Sensillae with barbs for entire length, or only basally, and then with ciliations distally, or with outstanding ciliations for the whole length 7

6. Posterior dorsal setae with a subapical setule longer than the other setules and as long as or longer than the setae themselves. Dorsal setae from 20 to 30μ long, excluding the subapical setule. Tarsi I 1·8 times as long as high and only slightly longer than metatarsi I. (Nymph). *Schöngastia* (*Schöngastia*) *Oudemansi* (Walch 1922). (= *impar* Gunther 1939 = *bodensis* Gunther 1940. =*muris* Walch 1927 *nec oudemansi* Walch 1927).

Dorsal setae pectinate without above subapical setule, with outstanding setules, to 30μ long. Tarsi I twice as long as high, metatarsi slightly longer than tarsi are high. (Nymph). *Schöngastia* (*Schöngastia*) *maldiviensis* Radford 1946.

Dorsal setae pectinate without above subapical setules, with outstanding setules of moderate length to 56μ long. Tarsi I 1·64 times as long as high and metatarsi I not as long as tarsi I are high. (Nymph). *Schöngastia* (*Schöngastia*) *vieta* Gater 1938.

7. Sensillae with only barbs for their entire length. Dorsal setae 15 to 25μ long. Tarsi I 1·7 times as long as high, and 1·3 times as long as metatarsi. (Nymph) (after Walch). *Schöngastia* (*Schöngastia*) *schuffneri* (Walch 1922).

Sensillae with outstanding ciliations for the whole length. DS posteriorly to 16μ. Front tarsi 1·7 times as long as high and one-sixth as long again as metatarsi. *Schöngastia* (*Ascoschöngastia*) *malayensis* Gater 1932.

Sensillae ciliated distally, basally with or without barbs 8

8. Sensillae very fine 9

Sensillae fairly and more or less uniformly thick with short ciliations or barbs basally and long ciliations distally 10

9. With a long nude seta in each angle in front of sensillary area. Sensillae minutely barbed basally and with 8–10 long ciliations distally. Dorsally setae from 20–30μ posteriorly. Tarsi I twice as long as high and twice as long as metatarsi. *Schöngastia* (*Schöngastia*), *oculicola* sp. n.

Without such seta in angles of crista. Sensillae distally with many short ciliations. Dorsal setae from 25μ to 90μ posteriorly. Tarsi I 2·2 times as long as high and 1·33 times as long as metatarsi. *Schöngastia westraliensis* (Wom. 1934).

10. Posterior dorsal setae to 96μ long and ending in a terminal setule ca. one-fifth entire length. Tarsi I 1·75 times as long as high and 1·6 times as long as metatarsi. (Nymph.) *Schöngastia* (*Ascoschöngastia*) *mutabilis* (Gater 1932).

Posterior dorsal setae to 50μ long, tapering with normal outstanding setules, without especially long terminal setules. Tarsi I nearly twice as long as high, and 1·17 times as long as metatarsi. (Nymph.) *Schöngastia* (*Ascoschöngastia*) *nadchatrami* sp. n.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) INDICA Hirst 1915.

Schöngastia indica Hirst 1915, Bull. Entom. Research, 6, 183.

Trombicula muris Walch 1922, Kitasato Archiv. Exper. Med., 5, (3); *non muris* Walch 1923 (24), Trans. Vth. Bien. Cong. Far East. Assoc. Trop. Med., (Singapore), 621, fig. 31–33.

Trombicula oudemansi Walch 1923 (24), Trans. Vth. Bien. Cong. Far East. Assoc. Trop. Med., 623, fig. 34–37; *non oudemansi* Walch 1922, Kitasato Archiv. Exper. Med., 5, (3); *non oudemansi*, Fletcher, Lesslar and Lewthwaite, 1928, Trans. Roy. Soc. Trop. Med. & Hyg., 22, 161.

Schöngastia indica, Walch 1927 Geneesk. Tijds. v. Ned. Indie, 67, (6), 924.

Neoschöngastia indica, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 118; Radford 1946, Parasitol., 37, (1–2), 51, fig. 26 a–e; Wharton 1946, Science, 104, (2,691), 76–77.

Ascoschöngastia indica, Wharton 1946, Ecol. Monog. 16, (3), 153–184.

Plate 100, fig. G–K.

The adults and nymphs of this species are well known. Walch was the first worker to succeed in rearing nymphs from larvae, but unfortunately, the difficulty of ensuring that the larvae are only of the one species before rearing, and thus establishing true correlation of nymphs with larvae led him to be mistaken in his resulting conclusions. More careful rearing of larvae to nymphs and adults, and of larvae from eggs laid by known adults by other workers, notably C. D. Radford, G. M. Kohls, and in particular carefully conducted research by G. W. Wharton 1946, has definitely established all the different stages, egg, larva, nymphochrysalis, nymph, imagochrysalis, and adult of both sexes, in this species.

Walch in his experiments, in all probability had larvae of two species in the tubes, viz. *indica* Hirst (= *muris* Walch) and *oudemansi* Walch. In 1946, the nymph of *indica* was described by Radford from larvae from Addu Attol, Maldive Islands, from which locality *oudemansi* is unknown. Thus, it was seen that the form of the sensillae as figured by Walch for *oudemansi* are as in *indica* and his figures for *muris* (*indica*) are really applicable to *oudemansi*. More recently Wharton (1946) working on this species at Guam, Mariana Is., has not only established all the stages as stated above but has described the external morphology in a very detailed manner. Further he has by experiment and careful observation contributed very greatly, not only to our knowledge of the bionomics of this particular species, but inferentially also to that of the Trombiculidae as a whole.

The descriptions of the adult and nymph from the specimens examined, one adult and one nymph from the Maldives, and 5 nymphs reared by Major G. M. Kohls from larvae found on *Dactylopsila* sp., from Dobodura, New Guinea, 1944 (No. 261) are as follows:

Adult. SB 42μ. Crista 90μ long, ratio crista to SB = 2·14. Sensillae 96μ. Tarsi I 109μ by 54μ, ratio length, height = 2·0; metatarsus I 88μ long, ratio tarsus I, metatarsus I = 1·24. Dorsal setae fairly uniform at 18μ to 25μ long.

Nymph. SB 30μ. Crista 85μ long (Maldives 75μ), (Radford 93μ), ratio crista to SB = 2·8. Sensillae 75μ (Maldives 55μ), (Radford 68μ). Tarsi I 60μ by 30μ.

This species is rather small, reddish in life, and of the usual figure of eight form. Crista rather short with the subposterior sensillary area triangular with posterior apex, and a pair of lightly clavate or spathulate sensillae with setules; the epistome is rounded with fine teeth and 1 long ciliated seta. Palpi somewhat slender; tibia with the usual 3 accessory spines at base of claw, and 1 other about midway between base of claw and articulation of the palpal tarsus, all on the inner side of palpi. Chelicerae finely serrate on inner margin. Eyes quite absent. The sternum is entire, roughly pentagonal, without any evidence of individual precoxal plates. The front tarsi are from 2 to 2·5 times as long as high, widest proximally, then slightly tapering. Dorsal setae short, fairly uniform, with long outstanding setules the whole length. In the male sex (according to G. W. Wharton 1946) on the genitalia on each side and arising between the second and third genital discs is a long curved ciliated and specialized seta.

Schöngastia (*Ascoschöngastia*) *indica* is apparently a widely distributed species, larvae having been recorded from India (Hirst), Ceylon (Radford), Maldives (Radford), Burma (Audy), Sumatra (Walch), Malaya (Gater), New Guinea (Womersley and Heaslip, Gunther and others), Australia (Womersley and Heaslip), and it occurs also in the Philippines. The nymphs and adults have been reared by Walch, Radford, Kohls, Wharton and Carver, and Jayewickreme. In the field, however, adults have only rarely been found, possibly due to their association with tree-climbing rats, for adults have been taken in the debris of rats' nests in the tops of coconut palms (Radford).

SCHÖNGASTIA ALGERICA (André 1932).

Thrombicula algerica André 1932, Bull. Soc. Zool. France, 59, 284–88.

Plate 100, fig. L–O.

In 1932 Dr. Marc André described and figured the adult of *Thrombicula algerica* from date palms in Algeria. Through his very great kindness I have

been able to study the type specimen and to compare it with adults of *indica* from Ceylon.

This species is very close to, and may possibly be synonymous with *indica*, in the short rather thickened to clavate sensillae, the form of the crista, of the epistome, and in leg dimensions and the length and form of the dorsal setae. The main points of difference are that the sensillae are rather more definitely clavate and with shorter ciliations than in *indica*, that the specialized seta on each side of the crista in front of sensillary area is absent, and that the ratio of length to height of the front tarsi is somewhat greater.

The data as given by André are:

Length 1,030μ, width 405–470μ. Dorsal setae 20–30μ long. Leg I 540μ, tarsi 150μ long by 60μ high, metatarsi 110μ long. Tibia with 3 accessory spines at base of claw and articulation of palpal tarsus. Epistome as in *indica*. In Sig Thor and Willmanns' recent work (aDs Tierreich Lfg. 71b, 1947), the palpal tibiae are stated as "median hinter der Kralle 4 Dornen." This includes the 3 spines at base of claw and one further away as stated above.

SCHÖNGASTIA (SCHÖNGASTIA) OUDEMANSI (Walch 1922).

Trombicula oudemansi Walch 1922, Kitasato Archiv. Exper. Med., 5, (3), (larva); *non* Walch 1924, Trans. Vth. Bien. Congr. Far East. Assoc. Trop. Med. (Singapore), 623 (nymph).

Trombicula muris Walch 1924, Trans. Vth. Bien. Congr. Far East. Assoc., Trop. Med. (Singapore), 621 (nymph); *non* Walch 1922, Kitasato Archiv. Exper. Med., 5, (3), (larva).

Schöngastia indica Hirst 1915, Bull. Entom. Res., 6, 183 (larva); Walch 1927, Geneesk. Tijds. v. Med. Indie, 67, (6), 924, (larva).

Neoschöngastia impar Gunther 1939, Proc. Linn. Soc. New South Wales, 64, (1–2), 85, (larva); Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 116 (larva).

Neoschöngastia bodensis Gunther 1940, Proc. Linn. Soc. New South Wales, 65, (5–6), 482, (larva).

Plate 101, fig. F–L.

This species was first reared to the nymph by Walch, but unfortunately he was apparently misled in his association of the larvae with the corresponding nymph (see remarks under *Ascoschöngastia indica*) and his description and figures of *oudemansi* nymph refer and correspond to *indica* (*muris*) and vice versa. The species has more recently been reared to the nymph by Major G. M.

Kohls from larvae on rats, at Dobodura, New Guinea (25 April, 1944, No. 253), which larvae were determined as *impar* Gunther. As shown under the discussion of the larvae, however, the chelicerae of both *impar* and *bodensis* are serrate, and these two species are both synonymous with *oudemansi* Walch.

The description of the nymph from 4 specimens received from Major Kohls is as follows:

Description of Nymph. Length 470μ, width across propodosoma 240μ, across hysterosoma 270μ. Crista typical of *Schöngastia*, to 90μ long, with triangular sensillary area, and paired nude filamentous sensillae to 120μ long and bases 40μ apart. Eyes quite absent. Chelicerae finely serrated on inner margin. Palpal tibia with 2 accessory spines at base of claw. Legs all shorter than body, with I the longest and strongest; I 400μ long, II 260μ, III 280μ; IV 320μ; tarsus I 90μ long by 50μ high, ratio length to height 1·8; metatarsus I 80μ, ratio length tarsus I to metatarsus I = 1·12. Dorsal setae fairly uniform, to 30μ long, with strong outstanding setules, one of which at the apex is exceptionally long, and as long as the posterior setae themselves; in Walch's fig. 36 (1924) which appears may be correctly given as *oudemansi*, a subapical seta is shown as slightly longer than the others, but otherwise the above characteristic appears to have been overlooked by Walch.

Loc. This species is known from Deli, Sumatra (Walch), New Guinea (Gunther, Kohls), and Borneo (Gunther).

SCHÖNGASTIA (ASCOSCHÖNGASTIA) MALDIVIENSIS (Radford 1946).

Schöngastia maldiviensis 1946, Parasitology, 37, (1–2), 48 (larva), 51, (nymph).

Plate 102, fig. A–L.

Radford's description of the larvae and more particularly of the nymph of this species are unfortunately rather inadequate although the figures are more satisfactory. The species was described from a lizard and also from rats from Addu Attol, Maldive Islands. The following remarks and data are from a nymph reared from larvae and kindly presented to me by Dr. Radford. The crista as seen, and as figured by Radford has the typical triangular form of the genus *Schöngastia*. The sensillae are about as long as the crista (given as 93μ), and are nude with their bases 30μ apart. The epistome is rounded, with fine denticulations, and one seta. The chelicerae are finely serrate on the inner margin. Eyes absent. Palpi rather slender; tibia with 2 accessory spines at base of claw. The dorsal setae are short, to 25μ thickest medially, and with setules. In the specimen examined, the crista is 59μ long, SB 26μ and the posterior dorsal setae to 30μ, slender, not thickened medially as in Radford's

figure, with outstanding setules, Tarsi I 90μ long by 45μ high, metatarsi I 52μ long.

Loc. So far, only known from Addu Attol, Maldive Islands. A solitary adult collected by S. L. Kalra, at Gudalur, India, 23 Aug. 1947 has been kindly sent to me for study by Dr. C. D. Radford. This specimen appears to be the adult of Radford's *maldiviensis,* but further material of both adults and larvae from the same locality are required to put this beyond question. The specimen, however, is described and figured herewith, and the figures may be compared with those given of a nymph from the Maldives.

Description of the Adult ♀. Length 850μ; width across propodosoma 450μ, across hysterosoma 520μ. Colour in life unknown. Crista elongate, 182μ, with a triangular posterior sensillary area, with fine, nude, filamentous sensillae, ca. 100μ log, and their bases 58μ apart. Epistome rounded-conical with strong denticulations, and 1 ciliated seta. Eyes quite absent. Palpi stout, with stout claw with 3 accessory spines at base of claw and another midway on outer margin of tibia; tarsus widest medially, and not reaching tip of claw. Legs I stronger and longer than rest, 715μ, II and III 455μ, IV 590μ; tarsi I 182μ long by 104μ wide, metatarsus I 130μ long. No precoxal plates on coxae I and with enclosed sternum. Dorsal setae fairly uniform, with strong ciliations and posteriorly reaching 40μ in length. Genital aperture with 3 pairs of discs.

SCHÖNGASTIA (SCHÖNGASTIA) SCHUFFNERI (Walch 1923).

Trombicula schuffneri Walch 1923, Kitasato Archiv. Exper. Med., 5, (3), (larva); 1924, Trans. Vth. Bien. Congr. Far East. Assoc. Trop. Med., (Singapore), (nymph); 1927, Geneesk. Tijds. v. Neder. Indie, 64, (3), (nymph).

Neoschöngastia schuffneri, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 117 (larva).

Plate 101, fig. M–O.

The nymph is still only known from those reared by Walch, and the following data and the figures are from his studies.

Nymph. Length 426μ, width across propodosoma 202μ, across hysterosoma 212μ. Colour in life orange red. Dorsal setae colourless, more or less tapering, ciliated, from 15 to 25μ long. Crista 52μ long, with sensillae 111μ long and with minute barbs basally, slightly longer distally, sensillae bases 25μ apart. Palpal tibia with 2 accessory spines at base of claw. Eyes absent. Epistome rounded with fine denticulations and 1 seta. Chelicerae serrate on inner margin. Legs all shorter than body, I 273μ long and stronger than others, II 147μ,

III 132μ, IV 177μ; tarsus I 1·7 times as long as high, and 1·3 times as long as metatarsus I. Sternum entire, without trace of precoxal plates.

In the form of the sensillary area this species belongs to *Schöngastia*. It can be recognized from other known adults or nymphs by the characteristically barbed sensillae as in the key.

SCHÖNGASTIA WESTRALIENSIS (Womersley 1934).

Microtrombidium westraliense Womersley 1934, Rec. S. Aust. Mus., 5, (2), 188.

Plate 104, fig. A–F.

As this species has the characteristic facies of the Trombiculidae and a triangular sensillary area of the crista it is now placed in the genus *Schöngastia* Ouds. It is still only known from the unique specimen from under a stone, Mundaring Weir, Western Australia, August 9, 1931 (H.W.).

The species is separated as in the key and a re-description is as follows:

Adult. Of typical Trombiculid facies. Size moderate, length to 1·2 mm.; width across propodosoma 800μ, across hysterosoma 930μ. Crista 165μ long, with subposterior triangular sensillary area with posterior apex, and carrying a pair of filamentous sensillae 120μ long, their bases 48μ apart, and ciliated distally. Epistome rounded with fine denticulations and 1 seta. Eyes absent. Chelicerae finely serrate on inner edge. Palpi moderately stout; tibia with 3 accessory spines near base of claw, and one other more basad. Sternum entire, without trace of precoxal plates. Legs all shorter than body, I the longest and strongest, 840μ long, II 530μ, III 530μ, IV 670μ; tarsi I elongate, 200μ long by 90μ high, ratio = 2·22; metatarsus I 150μ long, ratio length tarsus I, metatarsus I = 1·33. Dorsal setae tapering, 25μ anteriorly gradually increasing to 90μ. Colour in life reddish.

SCHÖNGASTIA (SCHÖNGASTIA) OCULICOLA sp. n.

Plate 103, fig. G–L.

Description of Nymph. More elongate but otherwise of typical Trombiculid facies. Length of newly-emerged specimens to 580μ; width across propodosoma 342μ, greater than across hysteromosa 260μ. Crista linear 70μ long, with triangular sensillary area enclosing a dumb-bell shaped areola, and furnished with filamentous sensillae, 75μ long, basally with minute indistinct barbs and distally with 8–10 long branches; sensillae bases 31μ apart; on each side of the stem of the crista is a single long seta, nude or apparently nude. Epistome not visible in preparations but with 1 ciliated seta (in one specimen 2 setae). Eyes entirely absent. Palpi stout; tibia with strong claw flanked at

its base by two accessory spines which are almost as large, long and strong as the claw; a third strong spine midway between base of claw and articulation of tibia; chelicerae with fine inner serrations. Legs I the longest and strongest, 350μ long, II 220μ, III 220μ, IV 260μ; tarsi I 91μ long by 45·5μ high, metatarsi I 45·5μ long. Sternum entire; no precoxal plates. Dorsal setae uniform, 20–22μ long, tapering with few long outstanding setules. Genital discs 2 pairs.

Remarks. The above description is from 4 specimens reared by Mr. S. H. Jayewickreme from larvae from the conjunctival sacs of *Leggada booduga fulvidiventris* from Nalanda, Ceylon, July 1944. The correlation was checked against recovered larval pelts.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) MALAYENSIS (Gater 1932).

Neoschöngastia malayensis Gater 1932, Parasitology, 24; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), (as larvae).

Plate 104, fig. G–J.

Description of Nymph. Of typical Trombicula facies. Colour in life ? Length to 416μ, width across propodosoma 260μ, across hysteromosa 286μ. Crista linear, 84μ long, with subposterior triangular sensillary area with the apex posteriad; sensillae to 56μ long with outstanding ciliations for the whole length, and the bases 42μ apart; epistome rounded conical, dentate with seta 16μ long. Eyes absent. Chelicerae with finely serrate dorsal edge. Palpi fairly stout; tibia with single claw and two strong accessory spines at base. Legs : I stronger than rest to 325μ long, II 234μ, III 234μ, IV 260μ; claws normal; precoxal plates absent; tarsus I 70μ long by 42μ high, metatarsus I 61·6μ long. Dorsal setae uniform, 16μ long, tapering, with outstanding setules. Genital discs 2 + 2.

Loc. Reared by Dr. Audy and his colleagues from larvae on *Rattus canus* from Kepong Forest Reserve, and Bk. Langan, Selangor, F.M.S., March, 1950,

Remarks. As with other species of the genus, *S.* (*A.*) *malayensis* in the nymph can only be separated on somewhat intangible features as in the key.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) LANIUS (Radford 1946).

Neoschöngastia lanius Radford 1946, Proc. Zool. Soc. London, 116, (2), 262, fig. 23–24 (as larvae).

Plate 102, fig. M–P.

Description of Nymph. Unfed, length to 780μ, width across propodosoma 383μ, across hysterosoma 412μ. Colour in life ? Crista elongate, 118μ long with subposterior, laterally rounded, sensillary area; with SB 32μ and sen-

sillae very thin basally then thickening until near the tip where they taper to a point, to 100μ long and furnished with short sparse ciliations; epistome more or less conical, very indistinct and dentate, epistomal seta 22μ long. Eyes absent. Chelicerae finely serrate on inner margin. Palpi as figured, with 2 accessory strong spines at base of claw and a strong seta on outer side; the tip of the palpal tarsus with a nude S-shaped seta, and the sensory rod on the outer side unusually long. Legs I 486μ long, II 284μ, III 312μ IV 355μ; tarsi I 102μ long by 48μ high, metatarsi I 64μ. Dorsal setae pectinate, short, posteriorly to 22μ, with sparse strong ciliations.

Remarks. A number of nymphs have been reared by Mr. K. L. Cockings, from larvae identified as *lanius* Radford and the identification checked against the recovered larval pelt. The larvae were from *Rattus rattus brunneusculus* from Imphal, Burma, 1945.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) KOHLSI (Philip and Woodward 1946).

Neoschöngastia kohlsi Philip and Woodward 1946, Amer. J. Trop. Med., 26, (2), 159, fig. B. and D. (as larvae).

Plate 101, fig. A–E.

As reported in the Larval Section of this paper, the larvae of this species is common in the Imphal district of Burma, and I am indebted to Lt.-Col. J. R. Audy and his colleague, K. L. Cockings, for the opportunity of describing here the nymph, a number of specimens of which Mr. Cockings was successful in rearing. As with other groups of Trombiculidae the specific characters of the nymphs (and adults) are anything but easy to determine. It is believed, however, that this and other species may be separated as in the key.

Description of Nymph. Facies as in typical *Trombicula.* Colour in life ? Length (newly emerged) 780μ; width across propodosoma 385μ, across hysterosoma 397μ. Crista elongate, length excluding epistome 96μ, with epistome 118μ; with typical shape of sensillary area, with SB 22μ, and sensillae 70μ long, broadened and lanceolate from ca. one-quarter from base, and tapering to a point apically and with short barbs basally and longer, but short ciliations on body. Epistome rounded conical, dentate, with one seta 18μ long. Eyes absent. Chelicerae with finely serrate inner margin. Palpi normal, tibia with two strong accessory stout spines at base of claw, and another strong spine on outer surface; tarsi with only 1 nude apical spine, and the sensory rod on outer surface longer than usual. Legs I longer and stronger than rest, 397μ, II 280μ, III 280μ, IV 355μ; tarsi I 112μ long by 58μ high, metatarsi I 64μ long, and not more than half the height of tarsi wide. Dorsal setae uniform, pectinate as figured with strong setules, to 20μ long posteriorly.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) MUTABILIS (Gater 1932).

Neoschöngastia mutabilis Gater 1932, Parasitology, 24; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 111, pl. VII, fig. 5 (as larvae).

Plate 103, fig. A–F.

This species is so far only known from a single nymph reared by Mr. K. L. Cockings from what was thought to be a larva of *lanius* Radford, and from a rat from Imphal, 22/12/1945. The pelt, as far as the scutum and palpal setae are seen, appears to be that of *S.* (*A.*) *mutabilis* (Gater), and the nymph as in the following description is very different from a number of other reared nymphs from *lanius* larvae.

Description of Nymph. Of typical *Trombicula* facies. Length 640μ; width across propodosoma 326μ, across hysterosoma 355μ. Crista elongate with subposterior sensillary area, length excluding epistome 86μ, with epistome 112μ; epistome rounded-conical with 1 ciliated seta 25μ long, and dentate margin; sensillae thick with parallel sides, short barbs basally and long setules distally, to 80μ long and bases 32μ apart. Eyes absent. Chelicerae with finely serrate inner margin. Palpi with 2 strong accessory spines or claws at base of claw, and a nude spine on outer surface; sensory rod on outer surface of tarsi rather long, apical spine single. Dorsal setae of two forms, shorter anterior setae 25μ long, with strong setules and ending in a long fine setule, about one-fifth of total length. Genital discs two pairs. Legs I longer and stronger than rest, 360μ, II 255μ, III 255μ, IV 310μ; tarsi I 99μ long by 57μ high, metatarsi I 61μ long.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) AUDYI sp. n.

Plate 105, fig. F–I.

Description of Nymph. Of typical *Trombicula* facies. Length to 405μ; width across propodosoma to 195μ, across hysterosoma to 260μ. Crista elongate, 70μ long, with subposterior, roughly triangular sensillary area, with paired narrowly clavate or lanceolate sensillae furnished with short setules; sensillae bases 28μ apart. Epistome probably rounded-conical and dentate; epistomal seta 20μ long. Eyes absent. Chelicerae serrate on inner edge. Palpi small, tibia with simple claw and two accessory spines at base of claw. Dorsal setae short and rather sparse, mainly 15μ long, but on extreme posterior to 25μ; with rather prominent outstanding setules. Leg I longer and stronger than rest, 305μ long, II and III 175μ, IV 227μ; tarsi I as figured, 70μ long by 33μ high; metatarsi I 42μ long and as high as tarsi I. No precoxal plates on leg I, but sternum enclosed posteriorly. Genital discs 2 pairs.

Loc. Described from 6 nymphs reared by Mr. K. L. Cockings in Malaya, from larvae from *Callosciurus nigrovittatus* and *C. notatus,* from Bukit Lagong Forest Reserve, Kepong, Malaya 1950. The nymphs were correlated with the larval pelts.

Remarks. Can be distinguished from other nymphal species as in the key.

SCHÖNGASTIA (SCHÖNGASTIA) VIETA Gater 1932.

Schöngastia vieta Gater 1932, Parasitology, 24, 154; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 103; Sig Thor and Willmann 1947, Das Tierreich, 71b, 308. (As larvae).

Plate 105, fig. A–E.

Description of Nymph. Of typical *Trombicula* facies. Length 360μ; width across propodosoma 208μ, across hysterosoma 266μ. Crista elongate, to 98μ (excl. epistome) with subposterior, roughly triangular sensillary area; with paired long and apparently entirely nude sensillae to 112μ long, their bases 36μ apart. Epistome rounded-conical, dentate, with epistomal seta 56μ long. Eyes absent. Chelicerae with finely serrate inner edge. Palpi with simple tibial claw and two accessory spines at its base. Dorsal setae gradually increasing in length posteriorly to 56μ long, not very tapering, with long outstanding setules. Legs I longer and stronger than the rest, to 312μ, II and III 195μ, IV 260μ; tarsi I ovoid, 78·4μ long by 47·6μ high; metatarsi I 44·8μ long. Sternum entire, with no precoxal plates on leg I.

Loc. Described from two nymphs reared by Mr. K. L. Cockings of the British Scrub typhus Research Team in Malaya from larvae from *Rattus r. diardi* from Kuching, Sarawak, 1950. The nymphs were correlated with the larval pelts.

Remarks. As with most species, the nymphs can only be separated from others on very intangible characters as in the tentative key given here.

SCHÖNGASTIA (ASCOSCHÖNGASTIA) NADCHATRAMI sp. n.

Plate 114, fig. D–F.

Description of Nymph. Of typical *Trombicula* facies. Length to 804μ, width across propodosoma 402μ, across hysterosoma 469μ. Crista elongate 196μ including epistome, with subposterior sensillary area, sensillae bases 60μ apart; sensillae 100μ, ciliated distally; epistome dentate and rounded-conical with one ciliated seta. Eyes absent. Chelicerae finely serrate on inner margin. Palpi normal, with single tibial claw and a pair of accessory spines at base of claw. Dorsal setae thickly disposed, gradually lengthening from 23μ anteriorly

to 50μ posteriorly, with strong ciliations. Legs: I longer and stronger than the rest, to 777μ, II 536μ, III 536μ, IV 602μ; tarsi I elongate oval, 161μ long by 87μ high, metatarsi I 137μ long; no precoxal plates.

Loc. Two nymphs reared by Mr. Nadchatram of the Scrub Typhus Research Unit, I.M.R. Kuala Lumpur from larvae from *Rattus sabanus* from Ulu Langat, F.R. Selangor, 1950. The nymphs were checked against the larval pelts.

Genus NEOSCHONGASTIA Ewing 1929.

Neoschöngastia Ewing 1929. A Manual of External Parasites, 187; Wharton and Hardcastle 1946, J. Parasitol., 32, (3), 286–322.

Paraschöngastia Womersley 1939, Tr. Roy. Soc. S. Austr., 63, 165.

Genotype *Schöngastia americana* Hirst 1921.

Ewing erected this genus for those larval species of *Schöngastia* in which the chelicerae did not possess teeth on the dorsal (inner) margin. In 1939 the genus *Paraschöngastia* Womersley was separated off for certain species in which there was a distinct ridge on the dorsal scutum anterior of the sensillae. The type of this genus was *Neoschöngastia yeomansi* Gunther 1939. It has since been shown, however, that *N. yeomansi* and *N. americana* are congeneric, and therefore *Paraschöngastia* is synonymous with *Neoschöngastia*. For the remainder of the species in Ewing's *Neoschöngastia* the generic name of *Ascoschöngastia* has been assigned (Ewing 1946).

The adult or nymphal stages remained unknown until Wharton and Hardcastle 1946, described the nymphs of two species from Guam and Okinawa in the Western Pacific. One of these, *Neoschöngastia carveri* Wharton and Hardcastle, was reared from larvae definitely determined as the same species. The second one, however, is as yet specifically uncertain as the authors had larvae of both *N. americana solomonis* Wharton and Hardcastle and *N. monticola* Wharton and Hardcastle, in the rearing tubes.

A third species of which the nymphs are known is *Neoschöngastia gallinarum* (Kawamura and Yamaguchi 1921) from Formosa (Hatori) and Federated Malay States (Fletcher, Lesslar and Lewthwaite).

A diagnosis of the genus based on the nymphal stages is as follows, after Wharton and Hardcastle 1946:

Diagnosis of Genus. Nymph. With the facies of *Trombicula.* Sensillary area entire, not divided into sections by longitudinal ridges, and reniform with the hilus directed anteriorly. Striae extending over sensillary area. No eyes. Six setae on palpal segment IV. Two types of opisthosomal body setae, a long and a short. Pseudostigmatic organs or sensillae spathulate, although at times almost filiform.

Key to the Known Nymphal Species.

1. Sensillae whip-like with thicker stem and fine filamentous lash, nude except for indistinct and sparse barbs on stem. Apex of sensillary area truncate. Epistome with 5 strong broad teeth and 2 setae. Palpal tarsus short, broader and truncate apically. Dorsal setae of two lengths, 27 and 50μ.

Neoschöngastia carveri Wharton and Hardcastle 1946.

Sensillae narrowly or more widely spathulate with long or short ciliations 2

2. Sensillae very narrowly spathulate, with long ciliations. Posterior apex of sensillary area pointed. Epistome with 7 teeth and 1 seta. Palpal tarsus of normal shape. Dorsal setae of two lengths 20–23μ and 50–70μ.

Neoschöngastia sp. (either *americana solomonis* Wh. and Hle. 1946, or *monticola* Wh. and Hle. 1946.

Sensillae broadly spathulate or clavate, with short ciliations. Posterior apex of sensillary area pointed. Epistome rounded and dentate. Dorsal setae of two kinds, mainly tapering to 16–20μ but interspersed posteriorly with uniformly thick setae to 45μ.

Neoschöngastia gallinarum (Hatori 1920).

NEOSCHÖNGASTIA CARVERI Wharton and Hardcastle 1946.

J. Parasitology, 1946, 32, (3), 313.

Plate 106, fig. EμI.

Description of Nymph (after Wharton and Hardcastle). Shape not quite typical of *Trombicula* in the unique specimen as the shoulders were indistinct. Length 850μ; width across propodosoma 370μ, across hysterosoma 350μ. Body thickly clothed with ciliated setae, and integument between setal bases striated. Crista with somewhat reniform sensillary area with hilus directed anteriorly; epistome with 7 strong teeth and two ciliated setae; sensillae 37μ apart, and ca. 100μ long, filamentous, thicker on basal third and with a few minute barbs, distal two-thirds lash-like; cuticle over sensillary area folded and striate. Eyes absent. Palpi short and stout; genu wider than long; tibia with two accessory spines at base of claw; tarsus short, truncate and widest apically. Chelicerae serrated on inner (dorsal) edge. Legs I the longest; tarsus I 147μ long by 50μ wide; metatarsus I 67μ long. Dorsal setae of three types; the anterior setae finer than posterior setae which are either long, 50μ, or short, 27μ, arising from papillae, and tapering with short ciliations. Genitalia with 2 pairs of discs, the anterior pair being oval and longer than the posterior pair.

Loc. Only known from a single nymph reared from larvae from a reef heron *Demigretta sacra* from Port Ayayan, Guam, July 17, 1945, by R. K. Carver. The larval skin was identified and so correlated with the nymph. (Wharton and Hardcastle 1946).

NEOSCHÖNGASTIA sp. Wharton and Hardcastle 1946.

J. Parasitology, 1946, 32, (3), 320.

Plate 106, fig. J–M.

Description of Nymph (after Wharton and Hardcastle 1946). Shape as in typical *Trombicula.* Length 670–710μ; width across propodosoma 300–390μ, across hysterosoma 340–390μ. Body thickly clothed with ciliated setae. Integument posteriorly with discs from which the setae arise, with striations between. Crista with reniform, striated sensillary area, the posterior angle of which is pointed; sensillae short, 60μ approximately, lightly spathulate and with long fine ciliations; their bases 37–43μ apart. Eyes absent. Epistome with 5 strong teeth and 1 seta. Chelicerae with the inner (dorsal) edge finely serrated. Palpi stout, genu about as long as wide, tibia with two strong accessory spines at base of claw; tarsus of normal shape and length. Legs all shorter than body, I the longest; tarsi I 120–133μ long by 50μ–60μ wide, metatarsus I 77μ to 96μ long. Dorsal setae arising from discs, of two types, from 50–70μ long and from 20–23μ long, stouter and blunter than in *carveri,* thickly furnished with short ciliations. Genitalia with two pairs of subcircular discs.

Loc. From larvae on a rock thrush, *Monticola solitarius* from Okinawa, 16 June, 1945. As the authors had two species of larvae, *Neoschöngastia americana solomonis* Wharton and Hardcastle, and *Neoschöngastia monticola* Wharton and Hardcastle in the rearing tube from which nymphs were obtained, they were unfortunately unable to assign the nymphs to either one of these species.

NEOSCHÖNGASTIA GALLINARUM (Hatori 1920).

Trombicula gallinarum Hatori 1920, Taiwan Igakkai, No. 209, pl. II, fig. 1–6 (larvae); Kawamura and Yamaguchi 1921, Kitasato Archiv. Exper. Med., 4, 169; Fletcher, Lesslar and Lewthwaite 1928, Trans. Roy. Soc. Trop. Med. and Hyg., 22, 161.

Neoschöngastia gallinarum, Sugimoto 1936, J. Jap. Soc. Vet. Sci., 15, 201; Wharton and Hardcastle 1946, J. Parasitol., 32, (3), 292.

Paraschöngastia gallinarum, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 130.

Plate 106, fig. A–D.

The nymph of this species was originally reared by Kawamura and Yamaguchi from Formosan material. They did not very adequately describe it, although they gave certain data in tabular form, and fairly good figures of the crista, palpi, etc. The unusual clavate sensillae were particularly drawn attention to.

Apart from the reference the nymph does not appear to have been observed, or at least, referred to by later workers.

The larvae have been reported from Malaya, from fowls, as were Hatori's Formosan material.

Recently Dr. J. R. Audy at my request, kindly undertook to relocate this species in Malaya, and was successful in finding it on domestic fowls, in the I.M.R. compound at Kuala Lumpur.

From these larvae Audy has successfully reared a nymph, which he has sent on to me for study.

In the few features mentioned by Kawamura and Yamaguchi, this specimen fully agrees with their description and figures. It is to be noted that it is only a few setae posteriorly on the dorsum which reach 42–45μ in length, most of the dorsal setae are from 16–20μ long and more tapering.

A re-description from the nymph examined is as follows:

Description of Nymph. Of typical *Trombicula* facies, with a marked constriction between propodosoma and hysterosoma. Length 650μ, width across propodosoma 325μ, across hysterosoma 350μ. Crista short and linear with a posterior triangular sensillary area with paired, clavate, setulose sensillae 45μ long by 8μ wide, with their bases 34μ apart; length of crista, excluding epistome, 78μ; epistome rounded-conical with dentate margin and one seta to 16μ long. Eyes absent. Palpi moderately slender, tibia with curved claw and two stout spines at base of claw. Chelicerae with finely serrate inner (dorsal) edge. Dorsal setae rather sparse, of two kinds, mainly tapering to 16–20μ long, with outstanding setules, but posteriorly interspersed with uniformly thick setae, to 42–45μ long, and with outstanding setules. Legs all shorter than body, I 338μ, II 235μ, III 208μ, IV 235μ; tarsi I 84μ long by 39μ high, metatarsi I 52μ long. Genitalia with two pairs of ventral discs.

Subfamily GAHRLIEPIINAE nom. nov.[1]

for *Walchiinae* Ewing 1946, J. Parasitol., 32, (5), 435–440.

The subfamily Walchiinae was raised by Ewing for the genera *Walchia* Ewing 1931, *Gahrliepia* Ouds., 1912, *Schöngastiella* Hirst 1915 and *Gateria* Ewing 1938 on larval characteristics only, the adult or nymphal stages being then unknown. His diagnosis was as follows:

"Piercing part of chelicerae blade-like, upcurved, without a row of dorsal teeth and extending beyond apex of basal cheliceral segment. Tracheae and spiracles absent. Dorsal plate without median or submedian seta, frequently extending backward over part of dorsum of abdomen and bearing one or more pairs of dorsal abdominal setae. Pseudostigmatic organs not simple setae but modified into true sensillae. Abdomen frequently constricted near middle, but never with a pair of postero-dorsal plates. Legs rather short; tarsi three-clawed, but one or two claws frequently much reduced."

In 1943, Womersley and Heaslip did not recognize the genera *Schöngastiella* and *Gateria* as distinct from *Gahrliepia*. In the present paper, the nymphs of species belonging to both *Walchia* and *Schöngastiella* are described for the first time. In addition, although the larvae have not been specifically determined, I have seen the nymphs of at least two species of *Gateria* from Burma collected by the American team during the war.

All the above nymphs are very closely allied, only differing specifically in the details of the dorsal setae and the sensillae. They all agree, however, in possessing on the front tarsi, a peculiar subapical dorsal stump-like process, not found in any other group of the Trombiculidae. This feature is to be regarded as distinguishing in the nymphal (and probably also the adult) stage the subfamily Gahrliepiinae from the Trombiculinae, while as no other characters can be found to separate the nymphs of *Walchia, Gahrliepia, Schöngastiella* and *Gateria,* these should be considered as synonymous, or at most, but subgenera on the characters of the larval scutum. Thus the subfamily Gahrliepiinae will contain only the genus *Gahrliepia* Ouds. 1912 with *Typhlothrombium manus* Ouds. 1910 as genotype.

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[1] As the type genus of Ewing's subfamily is here considered as being congeneric and synonymous with *Gahrliepia* Ouds. 1912, it becomes necessary under Art. 5 of the International Rules of Zoological Nomenclature to change the subfamily name.

Genus GAHRLIEPIA Ouds. 1912.

Ent. Ber., 1912, 5, 237; Zool. Jahrb., Suppl. 14, 1912.

Genotype *Typhlothrombidium nanus* Ouds. 1910 (Larva).

(Including *Gahrliepia* Ouds. 1912. Entom. Ber. Ned. Ent. Ver. 5, nom. nov. for *Typhlothrombium* Ouds. 1910, Ent. Ber. Ned. Ent. Ver. 3, 102, preoc.; *Schöngastiella* Hirst 1915, Bull. Ent. Res., 6, 183; *Gateria* Ewing 1938, J. Wash. Acad. Sci., 28, (6), 295; *Gahrliepia* Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 136; *Walchia* Ewing 1931, Proc. U.S. Nat. Mus., 80, (8), 19; Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 134).

Diagnosis of Genus from Nymph. Shape typical of *Trombicula*. Crista linear, with widely transverse dumb-bell like sensillary area and paired filamentous sensillae. Eyes absent. Palpal tibia with 2 accessory spines at base of claw. No precoxal plates. Sternum entire. Epistome rounded, denticulate, with 1 seta. Tarsi of leg I with a characteristic slump-like process dorsally and subapically.

Nymphal Genotype *Schöngastiella disparunguis* Ouds. 1929.

Key to the Known Species of Nymphs.

1. Sensillae with fairly long to long ciliations for the whole or part of their length 2
   Sensillae with only short ciliations 3

2. Sensillae with only short barbs on the basal fifth, and then long outstanding ciliations. Dorsal setae graduating from 16μ long anteriorly to 32μ posteriorly. Tarsi of leg I half as long again as high, and half as long again as metatarsi.
   Gahrliepia (*Walchia*) *disparunguis* Ouds. 1929.

   Sensillae with only fairly long ciliations for their whole length. Dorsal setae to 28μ long posteriorly. Tarsi and metatarsi of leg I of about the same proportions as above.
   Gahrliepia (*Walchia*) *lewthwaitei* Gater 1932.

   Sensillae with short barbs on basal half, and then long stiff setules. Dorsal setae to 30μ long posteriorly. Tarsi of leg I two-fifths as long again as high, and half as long again as metatarsi.
   Gahrliepia (*Walchia*) *rustica* Gater 1932.

3. Dorsal setae of two distinct sizes, 14μ long anteriorly and to 35μ posteriorly, stout, with strong setules. Tarsi half as long again as high, and half as long again as metatarsi.
   Gahrliepia (*Schöngastiella*) *ceylonica* sp. n.

   Dorsal setae gradually increasing in length posteriorly 4

4. Dorsal setae posteriorly to 64μ long, thick with strong setules. Sensillae barbed on basal third then with short ciliations. Tarsi I 1·6 times as long as high and slightly more than this longer than metatarsi. *Gahrliepia* (*Schöngastiella*) *ligula* (Radford 1946).

   Dorsal setae more slender 5

5. Sensillae slightly lanceolate, being wider medially than basally, with short ciliations. Dorsal setae to 30μ. Tarsi I 1·4 times as long as high, and 1·5 times as long as metatarsi. *Gahrliepia* (*Walchia*) *enode* (Gater 1932).

   Sensillae not so, filamentous 6

6. Sensillae rather thick, with short ciliations on basal half lengthening distally. Dorsal setae from 20 to 25μ long, tapering, with outstanding setules. Tarsi I 1·6 times as long as high and as long as metatarsi. *Gahrliepia* (*Schöngastiella*) *punctata* (Radford 1946).

   Sensillae rather thick, basal third with barbs, distally with longer ciliations. Dorsal setae posteriorly to 30μ long. Tarsi I 1·8 times as long as high, and 1·8 times as long as metatarsi. *Gahrliepia* (*Gahrliepia*) *ciliata* Gater 1932.

   Sensillae rather thick, but tapering, barbed on basal third, then with long ciliations. Dorsal setae posteriorly to 24μ long, curved, with strong setules. Tarsi I 1·4 times as long as high and 1·68 times as long as metatarsi. *Gahrliepia* (*Gahrliepia*) *ornata* sp. n.

   Sensillae fine, with short ciliations. Dorsal setae to 32μ long, with outstanding setules. Tarsi I 1·5 times as long as high, and 1·65 times as long as metatarsi. *Gahrliepia* (*Gateria*) *hirsuta* (Radford 1946).

GAHRLIEPIA (WALCHIA) DISPARUNGUIS (Oudemans 1929).

Schöngastiella disparunguis Ouds. 1929, Ent. Ber., 17, (165), 398.

Walchia disparunguis, Womersley 1944, Tr. Roy. Soc. S. Austr., 68, (1), 101.

Plate 107, fig. I–M.

Description of Nymph. Shape as in typical *Trombicula*. Colour in life whitish. Length to 450μ; width across propodosoma 270μ, across hysterosoma 300μ. Crista linear, 56μ long, rather indistinct apically; epistome rounded with denticulations and 1 seta; sensillary area widely transverse, 65μ, with a short posterior apex, and paired filamentous sensillae with short ciliations basally, longer distally, to 90μ long and their bases 54μ apart. Eyes absent. Chelicerae with fine serrations on inner margin. Palpi rather slender, tibia with 2 strong spines at base of claw. Legs rather short, I the longest and strongest and 300μ long, II 210μ, III 210μ, IV 270μ; tarsi I ovoid, 75μ long by 54μ high, metatarsus I 54μ long; tarsi I provided dorso-apically with a characteristic short

claviform process; tarsi I and II with many long slightly curved sensory rods as well as the ciliated setae. Tarsal claws unequal. Dorsal setae uniform, with long outstanding ciliations, from 16μ anteriorly to 30μ posteriorly and arising from closely adjacent platelets.

Loc. Described from type and two paratype nymphs reared from engorged larvae from rats from Dobodura, New Guinea, 6 June, 1944 (No. 385), by Major G. M. Kohls.

GAHRLIEPIA (SCHÖNGASTIELLA) PUNCTATA (Radford 1946).

Schöngastiella punctata Radford 1946, Proc. Zool. Soc., London, 116, (2), as larvae.

For further larval synonymy see Larval Section.

Plate 108, fig. K–O.

This species from Manipur State, India, has hitherto only been known from the larvae.

I have now been priviliged to study a number of nymphs reared from larvae in Ceylon by Mr. S. H. Jayewickreme. The nymph is here described and figured.

In 1943 Womersley and Heaslip suggested that the larval genera *Schöngastiella* Hirst and *Gateria* Ewing could not be generically separated from *Gahrliepia* Oudemans, on the basis of the number and arrangement of accessory setae on the scutum, as had been done by Ewing.

In the present paper has been described the nymph of a species of *Gahrliepia* (*W. disparunguis* (Ouds.)), and the genus defined for the nymphal and probably the adult stage by the structure of the crista, absence of eyes, and particularly by the presence of a peculiar stump-like process dorsal and subapical on the front tarsus. In the nymphs of *Schöngastiella punctata* described below, as well as in the nymphs of other species of *Gahrliepia*, *Gateria* and *Walchia* described later, they are also to be found. It appears then, that not only are the characters used to separate these genera in the larvae unsound, but that they cannot be separated generically at all in the later stages. These genera must therefore be regarded as synonymous with, or at most only as subgenera of, *Gahrliepia*, on larval features.

Description of Nymph. Of typical *Trombicula* facies. Colour (in spirit) whitish. Length (of new emerged unfed nymph) 580μ; width across propodosoma 325μ, across hysterosoma 350μ. Crista short, linear, 70μ, with broad sen-

sillary area; sensillae rather thicker medially, 84μ long, basal third with minute barbs, then with strong, moderately long ciliations. Sensillae bases 45μ apart. Eyes absent. Epistome conical-trianglar, denticulate, with 1 seta. Chelicerae normal, inner edge finely serrated. Palpi rather slender; tibia with 2 accessory strong spines at base of claw. Legs I longer and stronger than the rest, 325μ, II 240μ, III 227μ, IV 292μ; tarsi I 78μ long by 50μ high with subapical dorsal stump, metatarsi 50μ long. No distinctly defined sternum and no precoxal plates. Dorsal setae uniform, short, 20–25μ, tapering with outstanding setules, and on conspicuous papillae. Genital discs 2 pairs.

Remarks. Described from 4 nymphs bred from larvae from around the vibrisae of *Millardia meltada meltada,* Embilipitiya, Ceylon, Jan., 1945 (2 specimens), and from same habitat on *Bandicota malabarica,* Nalanda, Ceylon, July, 1944 (2 specimens).

GAHRLIEPIA (WALCHIA) RUSTICA Gater 1932.

Gahrliepia rustica Gater 1932, Parasitology, 24, 167.

Walchia rustica, Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 136; Sig Thor and Willmann 1947, as Tierreich, 71b, 337 (as larvae).

Plate 107, fig. A–D.

Description of Nymph. Of typical *Trombicula* facies. Colour in life ? Length 338μ, width across propodosoma 160μ, across hysterosoma 182μ. Crista linear as figured, 44·8μ long, sensory area dumb-bell shaped, as broad as entire length of crista and with only shallow posterior angle; sensillae very long, 88μ, with short ciliations on basal half and long outstanding ciliations distally; epistome and epistomal setae not seen. Eyes absent. Chelicerae with finely serrate inner edge. Palpi normal, tibia with single claw and two stout spines at base of claw. Legs, I stronger than others, to 312μ long, II 195μ, III 182μ, IV 221μ; tarsi I 70μ long by 50·4μ high and furnished with the subapical dorsal stump-like process characteristic of the genus; metatarsi I 47·6μ long. Dorsal setae uniform, fairly long to 30μ, tapering with strong outstanding setules. Genital discs 2 + 2.

Loc. Described from some half-dozen nymphs sent to me by Dr. J. R. Audy and reared from larvae from *Rattus r. jarak* from Palau Jarak Is., in Malacca Straits, 26 Jan., 1950.

Remarks. Distinguished as in the key.

GAHRLIEPIA (WALCHIA) LEWTHWAITEI (Gater 1932).

Walchia lewthwaitei Gater 1932, Parasitology, 24 (larvae).

Plate 107, fig. E–H.

Description of Nymph. Of typical *Trombicula* facies. Length 450μ; width across propodosoma 227μ, across hysterosoma 292μ. Crista linear and short with wide subposterior sensillary area with a short angular posterior apex; total length of crista 56μ, SB 48μ; sensillae 84μ long with short ciliations in basal fourth, longer in remainder. Eyes absent. Chelicerae with finely serrated inner (dorsal) edge. Palpi fairly slender and normal, tibia with slender claw, and two accessory spines at its base. Legs, I the longest and thicker than the rest, to 292μ long, II 208μ, III 208μ, IV 260μ; tarsi I short and broad, 64·4μ long by 42·0μ high, metatarsi I 44·8μ long, and not as high as tarsi; tarsi I furnished with the dorso-apical stumpy process of the genus. Dorsal setae moderately sparse, tapering, to 28μ long posteriorly, and with outstanding setules.

Loc. Described from the type nymph and 6 paratypes reared from specimens on *R. whiteheadi* and *R. mulleri* from edge of Menyala Forest Reserve, near Port Dickson, F.M.S., 21 Oct. 1949. The nymphs emerged 31 Oct. and 1st Nov., 1949.

Remarks. It does not seem possible to satisfactorily separate the nymph of this species from those of *disparunguis* in a key. It is very similar in dimensions of tarsi and metatarsi I but the dorsal setae are shorter and more uniform in length.

The nymphs were reared by Mr. K. L. Cockings and checked against the recovered pelts. I am indebted to Dr. J. R. Audy and Mr. Cockings for the material from which the nymphal stage is described.

GAHRLIEPIA (WALCHIA) ENODE (Gater 1932).

Walchia enode Gater 1932, Parasitology, 24; *enodis* Womersley and Heaslip 1943, Tr. Roy. Soc. S. Austr., 67, (1), 135 (as larvae).

Plate 108, fig. A–E.

This species has been reared to the nymph by Mr. K. L. Cockings from Imphal material and I am indebted to Lt.-Col. Audy for the opportunity of studying this material and describing the nymphal stage.

The nymphs were correlated with the cast larval pelts.

Description of Nymph. Of typical *Trombicula* facies. Length 420μ; width across propodosoma 227μ, across hysterosoma 256μ. Crista short, length 51μ, epistome not discernible, sensillary area wider than anterior arm of crista, is long, and with sensillae bases 41μ apart; sensillae short, 64μ, strongly but shortly ciliated and lightly thickened in middle three fourths. Chelicerae with inner edge finely serrate. Eyes absent. Palpal claw with 2 accessory spines at base, apparently no nude seta or spine on outer surface; tarsi with I apical nude seta. Legs I longer and stronger than rest, 326μ, II 213μ, III 255μ, IV 280μ; tarsi I with the dorsal and subapical process characteristic of the subfamily, 73μ long by 51μ high, metatarsi I 48μ long. Dorsal setae to 30μ long, with long setules as figured. Genital discs two pairs.

Remarks. Larvae from *R. r. brunneusculus* from Imphal, Manipur State, India, Nov. 15, 1945.

GAHRLIEPIA (GATERIA) HIRSUTA (Radford 1946).

Gateria hirsuta Radford 1946, Proc. Zool. Soc. London, 116, (2), 249 (as larvae).

Plate 109, fig. D–H.

A single nymph of this species has been sent to me for study by Lt.-Col. Audy, which was reared by Mr. K. L. Cockings and the recovered pelt determined as a typical *hirsuta* Radford.

As with other species of *Walchia, Gateria,* and *Schöngastiella,* the nymph cannot be separated generically from *Gahrliepia* and all are characterized by the peculiar process on tarsus I.

Description of Nymph. Facies of typical *Trombicula.* Length (newly emerged) 497μ; width across propodosoma 241μ, across hysterosoma 256μ. Crista short, 48μ long, epistome indiscernible, sensillary area wider than arm of crista, with SB 40μ apart; sensillae filamentous, 80μ long, with short barbs basally and short ciliations distally. Eyes absent. Palpal claw with two accessory stout spines at base, and no outer spine on tibia; tarsus with only 1 nude apical spine. Legs I longer and stronger than rest, 340μ, II 170μ, III 180μ, IV 212μ; tarsi I short and stout, 80μ long by 54μ high, with a short dorso-apical blunt process; metatarsi I 48μ long. Dorsal setae stout with strong setules, to 30μ long, setules not as numerous as in *cnode.* Genital discs two pairs.

Loc. and Host. The larvae from which the above nymphs was reared was taken from a rat, at Imphal, Manipur State, India, 17 Dec., 1945 (K. L. Cockings).

GAHRLIEPIA (SCHÖNGASTIELLA) LIGULA (Radford 1946).

Schöngastiella ligula Radford 1946, Proc. Zool. Soc. London, 116, (2), 256 (as larvae).

Plate 108, fig. F–J.

This species is common in the region of Imphal, India, and Mr. K. L. Cockings has successfully reared a number of specimens through to the nymph, and checked the identification with the recovered larval pelts. I am indebted to Lt.-Col. Audy for the opportunity of examining and describing these nymphs.

Description of Nymph. Facies of typical *Trombicula* form. Length 400μ; width across propodosoma 214μ; across hysterosoma 242μ. Crista short, 57μ; epistome and seta indiscernible; sensillary area wide, with SB 57μ apart, and sensillae 120μ long, filamentous with short ciliations. Eyes absent. Chelicerae with finely serrate inner edge. Palpal tibia with two accessory stout spines at base of claw; no nude seta on outer surface; tarsi with a single nude spine at tip. Dorsal setae pectinate with strong setules, from 30μ long anteriorly to 60μ posteriorly. Legs I longer and stronger than rest, 312μ, II 185μ, III 171μ, IV 213μ; tarsi I 80μ long by 51μ high, and furnished with the characteristic dorso-apical stump-like process; metatarsi I 48μ long. Genital discs two pairs.

GAHRLIEPIA (SCHÖNGASTIELLA) CEYLONICA sp. n.

Plate 109, fig. A–C.

Description of Nymph. Of typical *Trombicula* facies. Colour in life unknown. Length to 520μ (newly emerged); width across propodosoma 260μ, across hysterosoma 220μ. Crista linear, 70μ long, anterior arm short, sub-posterior sensillary area wide, with sensillae bases 54μ apart; sensillae long, filamentous but moderately thick, with barbs on basal half and short ciliations distally; no specialized setae in front of sensillary area. Epistome rounded-conical with denticulations and 1 ciliated seta. Eyes absent. Chelicerae with finely serrate dorsal margin. Palpi fairly stout, tibia with 2 accessory spines at base of claw. Legs I longer and stronger than rest, 325μ long, II 195μ, III 195μ, IV 220μ; tarsi I 78μ long by 52μ wide and provided with a subapical dorsal stump-like process; metatarsi I 52μ long. Dorsal setae stout, not much tapering, and with numerous strong setules; of two sizes, anteriorly 14μ long, posteriorly to 35μ long. Genital discs 2 pairs.

Remarks. The above description is from one of four nymphs reared by Mr. S. H. Jayewickreme from larvae from the ears of *Rattus r. kandiyanus* from Nalanda, Ceylon, May, 1944.

GAHRLIEPIA (GAHRLIEPIA) CILIATA Gater 1932.

1932 Parasitology, 24.

Plate 115, fig. A–C.

Description of Nymph. Of typical *Trombicula* facies. Colour in life ? Length 536μ; width across propodosoma 268μ, across hysterosoma 335μ. Crista rather short but elongate, 60μ long, with subposterior sensillary area; sensillae bases 43μ apart; sensillae rather thick, to 82μ long, basal third with short barbs, distal part with longer ciliations; epistome difficult to see but apparently conical with one seta. Eyes absent. Inner edge of chelicerae finely serrate. Palpal tibia with single claw and two accessory spines at base. Dorsal setae from 18μ long anteriorly to 30μ posteriorly, rather straight with outstanding setules. Legs: I 402μ, longer and stronger than the others, II and III 228μ, IV 260μ; tarsi of leg I 90μ long by 50μ high, metatarsi I 50μ long; tarsi I furnished with the usual dorsal apical stump-like process. Genital discs two pairs.

Loc. A single nymph; provisionally identified by Mr. Nadchatram as *cetrata* Gater, but which is actually *ciliata* Gater, was reared by him from larva from *Rattus sabanus* from Ulu Langat Forest Reserve, Selangor, F.M.S., 12 Aug., 1950. The nymph was checked with the larval pelt.

GAHRLIEPIA (GAHRLIEPIA) ORNATA sp. n.

Plate 115, fig. D–F.

Description of Nymph. Of typical *Trombicula* facies. Colour in life? Length 496μ; width across propodosoma 268μ across hysterosoma 320μ. Crista rather short, 67μ, elongate, with subposterior sensillary area as figured; sensillae bases 40μ apart; sensillae rather thick but tapering to 84μ long, with short barbs on basal third then with long ciliations; epistome rather indistinct but apparently conical and dentate with single ciliated seta. Eyes absent. Chelicera with finely serrate inner edge. Palpi slender, tibia with simple claw and two accessory spines at its base. Dorsal setae rather short, from 16μ long anteriorly to 24μ posteriorly, tapering, curved and with strong setules. Legs: I longer and stronger than rest, to 335μ, II 228μ, III 228μ, IV 281μ; tarsi of leg I rather oval, 84μ long by 60μ wide, furnished with the usual subapical subdorsal stump-like process of the genus; metatarsi I 50μ long. Genitalia with two pairs of discs.

Loc. This very unusual larval species has been reared to the nymph by Mr. Nadchatram of the Scrub-typhus Research Unit from larvae on *Rattus* sp. Ulu Langat Forest Reserve, Selangor, F.M.S., Sept., 1950.

LIST OF SPECIES

(Including Appendix).

L. indicates known from larvae, N. from nymph, and A. from adult.

* Species known as adult or nymph from other than the Asiatic-Pacific Region.

Tragardhula acuscutellaris (Walch 1922). L.N.A.
Tragardhula japonica (Tanaka 1930). L.N.
Tragardhula tamiyai (Philip and Fuller 1950). L.
Tragardhula fujigmo (Philip and Fuller 1950). L.
Tragardhula nagayoi (Sasa 1950). L.
Tragardhula mitamurai (Sasa 1950). L.
Tragardhula geckobia sp. n. L.
Tragardhula pentagona sp. n. L.
Tragardhula gymnodactyla (Wom. and Kohls 1947). L.
Tragardhula velascoi (Boshell and Kerr 1942). * L.N.A.
Tragardhula attenuata (Michener 1946). * L.A.
Tragardhula alleei (Ewing 1926). * L.N.A.
Tragardhula nilotica (Ouds. 1904). * A.
Tragardhula peruviana (Ewing 1926). * A.
Ipotrombicula elegans (Wom. 1942). A.
Speotrombicula trifurca (Ewing 1933). * A.
Trombicula (*Trombicula*) *minor* Berl. 1905. A.
Trombicula (*Leptotrombidium*) *palpalis* (Nagayo *et al.* 1919). L.
Trombicula (? *Leptotrombidium*) *keukenschrijveri* (Walch 1922). L.
Trombicula (*Leptotrombidium*) *pallida* (Nagayo *et al.* 1919). L.A.
Trombicula (*Leptotrombidium*) *burnsi* (Sasa 1950). L.
Trombicula (? *Leptotrombidium*) *intermedia* (Nagayo *et al.* 1919). L.
Trombicula (? *Leptotrombidium*) *fuji* Kuwato *et al.* 1950). L.
Trombicula (? *Leptotrombidium*) *lanceolata* sp. n., Lawrence in MS. L.
Trombicula (? *Leptotrombidium*) *parapalpalis* sp. n. L.
Trombicula (? *Leptotrombidium*) *macacus* sp. n., Lawrence in MS. L.
Trombicula (? *Leptotrombidium*) *puta* sp. n. L.
Trombicula (? *Leptotrombidium*) *dux* sp. n. L.
Trombicula (? *Leptotrombidium*) *scutellaris* (Nagayo *et al.* 1920). L.
Trombicula (*Leptotrombidium*) *deliensis* (Walch 1922). L.N.A.
Trombicula (*Leptotrombidium*) *akamushi* (Brumpt 1910). L.N.A.
Trombicula (? *Leptotrombidium*) *villosa* sp. n. L.

Trombicula (? *Leptotrombidium*) *tithwalensis* sp. n. L.
Trombicula (? *Leptotrombidium*) *bhimtalensis* sp. n. L.
Trombicula (? *Leptotrombidium*) *longiseta* sp. n. L.N.
Trombicula (*Leptotrombidium*) *fulleri* (Ewing 1945). L.N.
Trombicula (*Neotrombicula*) *fordi* sp. n., Lawrence in MS. L.N.
Trombicula (? *Neotrombicula*) *traubi* sp. n. L.
Trombicula (*Neotrombicula*) *hastata* (Gater 1932). L.N.
Trombicula novae-hollandiae Hirst 1929. L.
Trombicula (*Neotrombicula*) *rara* (Walch 1922). L.N.
Trombicula (*Trombicula*) *hirsti* Sambon 1927. L.
Trombicula (*Trombicula*) *hirsti* f. *deliensis* (Walch 1923). L.
Trombicula (*Trombicula*) *hirsti* f. *hakei* Radford 1946. L.
Trombicula (*Trombicula*) *hirsti* f. *nissanensis* Dumbleton 1947. L.
Trombicula (? *Trombicula*) *sobrina* sp. n. L.
Trombicula (? *Trombicula*) *ablephara* sp. n. L.
Trombicula (*Trombicula*) *wichmanni* (Ouds. 1905). L.N.A.
Trombicula anous (Wharton 1946). L.
Trombicula pluvius (Wharton 1946). L.
Trombicula lygosomoides sp. n. L.
Trombicula (*Trombicula*) *samboni* (Wom. 1939). L.N.A.
Trombicula (*Neotrombicula*) *sarcina* (Wom. 1944). L.N.
Trombicula kanzalwanensis sp. n. L.
Trombicula (? *Trombicula*) *macropus* Wom. 1936. L.
Trombicula rioi Gunther 1939. L.
Trombicula (*Fonsecia*) *coluberina* (Radford 1946). L.
Trombicula batui Philip and Traub 1950. L.
Trombicula (*Neotrombicula*) *munda* (Gater 1932). L.
Trombicula (*Neotrombicula*) *spicea* (Gater 1932). L.N.
Trombicula (*Neotrombicula*) *consueta* sp. n. L.N.
Trombicula parmifera sp. n. L.
Trombicula lundbladi sp. n. L.
Trombicula nissani Dumbleton 1947. L.
Trombicula jubbulporensis sp. n. L.
Trombicula isshikii Sugimoto 1938. L.
Trombicula khurdangensis sp. n. L.
Trombicula (*Neotrombicula*) *scincoides* (Wom. 1944). L.N.A.
Trombicula (? *Neotrombicula*) *kohlsi* (Wom. 1944). L.
Trombicula (? *Neotrombicula*) *tovelli* sp. n. L.
Trombicula buxtoni sp. n. L.
Trombicula naultini Dumbleton 1947. L.

Trombicula cervulicola Ewing 1931. L.
Trombicula densipiliata Walch 1923. L.
Trombicula taphozous sp. n. L.
Trombicula corvi Kaw. and Yam. 1921. L.
Trombicula insolli (Philip and Traub 1950). L.
Trombicula leveri sp. n. L.
Trombicula (*Neotrombicula*) *harrisoni* sp. n. L.N.
Trombicula piercei Ewing 1931. L.
Trombicula (*Trombicula*) *frittsi* Wharton 1945. L.N.
Trombicula kashmirensis sp. n. L.
Trombicula incurva sp. n. L.
Trombicula vietzi sp. n. L.
Trombicula schmitzi (Ouds. 1914). L.
Trombicula (*Leptotrombidium*) *myzantha* sp. n. L.N.
Trombicula (*? Leptotrombidium*) *robusta* (Gunther 1941). L.
Trombicula rajoriensis sp. n. L.
Trombicula sylvestris Audy and Traub 1950. L.
Trombicula muridia sp. n. L.
Trombicula bodensis (Gunther 1940). L.
Trombicula gliricolens (Hirst 1915). L.
Trombicula philipi sp. n. L.
Trombicula (*Leptotrombidium*) *burmensis* (Ewing 1946). L.N.
Trombicula southcotti sp. n. L.
Trombicula quadriense Wom. and Heasp. 1943. L.
Trombicula pelta sp. n. L.
Trombicula (*Neotrombicula*) *jayewickremei* sp. n. L.N.
Trombicula (*Trombiculindus*) *cuneata* (Traub and Evans 1951). L.
Trombicula squamifera sp. n. L.
Trombicula (*Trombiculindus*) *squamosa* (Radford 1947). L.
Trombicula (*Trombiculindus*) *foliacea* (Traub and Evans 1951). L.
Trombicula thori sp. n. L.
Trombicula (*Trombicula*) *batatus* (Linn. 1758). * L.N.A.
Trombicula (*Trombicula*) *helleri* (Ouds. 1911). * L.A.
Trombicula (*Trombicula*) *splendens* Ewing 1913. * A.
Trombicula (*Trombicula*) *vanommereni* Schierbeck 1937. * L.N.A.
Trombicula (*Trombicula*) *alfreddugesii* (Ouds. 1911). * L.N.A.
Trombicula (*Trombicula*) *jacoti*. nom. nov. * A.
Trombicula (*Neotrombicula*) *inopinatum* (Ouds. 1909). * L.N.
Trombicula (*Neotrombicula*) *autumnalis* (Shaw 1790). * L.N.A.
Trombicula (*Neotrombicula*) *canestrinii* (Buffa 1899). * A.

Trombicula (*Neotrombicula*) *clavicata* (Andre 1937). * A.
Trombicula (*Neotrombicula*) *formicarum* (Berl. 1910). * A.
Trombicula (*Neotrombicula*) *camilla* Wharton 1938). * A.
Trombicula (*Neotrombicula*) *russica* (Ouds. 1902). * A.
Trombicula (*Neotrombicula*) *moesica* (Andre 1932). * A.
Trombicula (*Neotrombicula*) *coarctata* (Berl. 1888). * N.
Trombicula (*Neotrombicula*) *goldii* (Ouds. 1910). * L.A.
Trombicula (*Neotrombicula*) *cavernarum* (Ewing 1933). * A.
Trombicula sp. Cooreman *in litt.* * A.
Trombicula (*Neotrombicula*) *manriquei* (Ewing 1937). * A.
Tecomatlana melvini (Traub and Evans 1950). L.
Myotrombicula vespertilionis Wom. and Heasp. 1943. L.
Heaslipia gateri (Wom. and Heasp. 1943). L.N.
Novotrombicula owiensis Wom. and Kohls 1947. L.
Schöngastia (*Schöngastia*) *oudemansi* (Walch 1923). L.N.
Schöngastia (*Schöngastia*) *lewthwaitei* sp. n. L.
Schöngastia (*Schöngastia*) *vandersandei* (Ouds. 1905). L.
Schöngastia (*Schöngastia*) *schuffneri* (Walch 1923). L.N.
Schöngastia (*Schöngastia*) *taylori* Gunther 1940. L.
Schöngastia (*Schöngastia*) *whartoni* sp. n. L.
Schöngastia (*Schöngastia*) *bidentata* sp.n . L.
Schöngastia (*Schöngastia*) *vieta* Gater 1932. L.N.
Schöngastia (*Schöngastia*) *philipi* Wom. and Kohls 1947. L.
Schöngastia (*Schöngastia*) *blestowei* Gunther 1939. L.
Schöngastia (*Schöngastia*) *blestowei v. megapodius* Wom. and Heasp. 1943. L.
Schöngastia (*Schöngastia*) *oculicola* sp. n. L.N.
Schöngastia (*Schöngastia*) *pseudoschuffneri* (Walch 1927). L.
Schöngastia (*Schöngastia*) *maldiviensis* (Radford 1946). L.N.A.
Schöngastia (*Ascoschöngastia*) *pseudomys* sp. n. L.
Schöngastia (*Ascoschöngastia*) *mccullochi* (Wom. 1944) L.
Schöngastia (*Ascoschöngastia*) *uromys* (Wom. and Kohls 1947). L.
Schöngastia (*Ascoschöngastia*) *foliata* (Gunther 1940). L.
Schöngastia (*Ascoschöngastia*) *signata* sp. n. L.
Schöngastia (*Ascoschöngastia*) *globulare* (Walch 1927). L.
Schöngastia (*Ascoschöngastia*) *kohlsi* (Philip and Woodward 1946) L.N.
Schöngastia (*Ascoschöngastia*) *comata* sp. n. L.
Schöngastia (*Ascoschöngastia*) *lanius* (Radford 1946). L.N.
Schöngastia (*Ascoschöngastia*) *mutabilis* (Gater 1932). L.N.
Schöngastia (*Ascoschöngastia*) *edwardsi* (Gunther 1939). L.
Schöngastia (*Ascoschöngastia*) *philippensis* (Philip and Woodward 1946). L.

Schöngastia (Ascoschöngastia) mackerrasae sp. n. L.
Schöngastia (Ascoschöngastia) masta (Traub and Sundermeyer 1950). L.
Schöngastia (Ascoschöngastia) petrogale (Wom. 1934). L.
Schöngastia (Ascoschöngastia) mohri sp. n. L.
Schöngastia (Ascoschöngastia) crinita sp. n. L.
Schöngastia (Ascoschöngastia) rectangulare sp. n. L.
Schöngastia (Ascoschöngastia) cassiope sp. n. L.
Schöngastia (Ascoschöngastia) antipodianum (Hirst 1929). L.
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Schöngastia (Ascoschöngastia) innisfailensis (Wom. and Heasp. 1943). L.
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Schöngastia (Ascoschöngastia) lipoxena sp. n. L.
Schöngastia (Ascoschöngastia) nadchatrami sp. n. L.
Schöngastia (Ascoschöngastia) sarawakensis sp. n. L.
Schöngastia (Ascoschöngastia) nausheraensis sp. n. L.
Schöngastia (Ascoschöngastia) debilis Gater 1932. L.
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Schöngastia (Ascoschöngastia) labuanensis sp. n. L.
Schöngastia (Ascoschöngastia) audyi sp. n. L.N.
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Schöngastia (Ascoschöngastia) sockaboemiensis (Takekawa 1945). L.
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Schöngastia (Ascoschöngastia) traubi sp. n. L.
Schöngastia (Ascoschöngastia) lawrencei nom. nov. L.

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Neoschöngastia egretta Wharton and Hardcastle. 1946. L.
Neoschöngastia struthidia sp. n. L.
Neoschöngastia retrocincta Gunther 1939. L.
Neoschöngastia yeomansi Gunther 1939. L.
Neoschöngastia owiensis sp. n. L.
Neoschöngastia mcqueeni sp. n. L.
Neoschöngastia atollensis Wharton and Hardcastle 1946. L.
Neoschöngastia namrui Wharton and Hardcastle 1946. L.
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Neoschöngastia entomyza sp. n. L.
Neoschöngastia thomasi (Radford 1946). L.
Neoschöngastia pauensis Wharton and Hardcastle 1946. L.
Neoschöngastia salmi (Ouds. 1922). L.
Neoschöngastia dubia Gunther 1939. L.
Neoschöngastia ewingi Wharton and Hardcastle 1946. L.
Neoschöngastia riversi Wharton and Hardcastle 1946. L.
Neoschöngastia carveri Wharton and Hardcastle 1946. L.N.
Neoschöngastia sp. Wharton and Hardcastle 1946. N.
Mackiena empodiformis Traub and Evans 1950. L.
Gahrliepia (Walchia) morobensis (Gunther 1939). L.

Gahrliepia (*Walchia*) *rustica* Gater 1932. L.N.
Gahrliepia (*Walchia*) *turmalis* Gater 1932. L.
Gahrliepia (*Walchia*) *lewthwaitei* sp. n. L.N.
Gahrliepia (*Walchia*) *disparunguis* (Ouds. 1929). L.N.
Gahrliepia (*Walchia*) *ewingi* (Fuller 1951, nom. nov.). L.
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Gahrliepia (*Walchia*) *brennani* sp. n. L.
Gahrliepia (*Walchia*) *brennani* v. *ventralis* nov. L.
Gahrliepia (*Walchia*) *rioi* Gunther 1940. L.
Gahrliepia (*Schöngastiella*) *ligula* (Radford 1946). L.N.
Gahrliepia (*Schöngastiella*) *ceylonica* sp. n. L.N.
Gahrliepia (*Schöngastiella*) *brevis* (Radford 1946). L.
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Gahrliepia (*Gahrliepia*) *saduski* sp. n. L.
Gahrliepia (*Gahrliepia*) *ciliata* Gater 1932. L.N.
Gahrliepia (*Gahrliepia*) *insigne* sp. n. L.
Gahrliepia (*Gahrliepia*) *decora* sp. n. L.
Gahrliepia (*Gahrliepia*) *ornata* sp. n. L.N.
Gahrliepia (*Gahrliepia*) *cetrata* Gater 1932. L.
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Gahrliepia (*Gateria*) *romeri* sp. n. L.
Gahrliepia (*Gateria*) *rutila* (Gater 1932). L.
Gahrliepia (*Gateria*) *spinulosa* (Radford 1946). L.
Gahrliepia (*Gateria*) *fletcheri* (Gater 1932). L.

SUMMARY.

Total species mentioned	254
Exotic species (other than Asiatic-Pacific)	26
New species	77
Asiatic-Pacific species as Larvae	221
Asiatic-Pacific species as Adults and/or Nymphs	53
Species in which Larvae have been correlated with Adults and/or Nymphs:	
1. Asiatic-Pacific	46
2. Other than	10

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APPENDIX

Trombicula thori sp. n.

Plate 116, fig. A–E.

Description of larvae. (Only slightly engorged.) Shape elongate oval. Length 292μ, width 195μ. Scutum as figured, roughly rectangular, wider than long, with sparse punctuations; anterior margin sinuous with convex middle; posterior margin moderately deep behind line of PL, flattish medially; sensillae missing but probably filamentous, their bases wide apart and much nearer to AL than to PL. Eyes 2 + 2, anterior the larger and strongly refringent. Chelicerae simple with only the apical tricuspid cap. Galeal setae nude, very narrowly blade-like with tapering and strongly bent tip. Palpi stout, tibial claw short and bifurcate; setae on femur, genu and tibia with only indistinct barbs. Dorsal setae 20 in number, to 40μ long and arranged 2.6.4.4.2.2. Ventrally with paired ciliated setae on maxillae, one finely barbed on each coxa, a pair of same between coxae I and between coxae III and thereafter 4.2.2.2, the last pair adanal. Legs all 7-segmented, I 325μ long, II 260μ, III 292μ; tarsi I and II with dorsal sensory rod (spur), III without any long nude setae (mastigalae); claws paired, empodium claw-like.

The Standard Data for the type and 8 paratypes are:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	87·4±0·62	1·87±0·44	81·8–93·0	84·0–89·6	2·1
PW	99·55±0·68	2·03±0·48	93·45–105·65	98·0–103·6	2·0
SB	61·45±0·36	1·08±0·25	58·2–64·7	58·8–63·0	1·7
ASB	14·0	No variation recorded.			
PSB	36·4	No variation recorded.			
SD	50·4	No variation recorded.			
A–P	32·45±0·47	1·40±0·33	31·25–39·65	33·6–36·4	4·0
AM	39·2	No variation recorded.			
AL	32·0±0·56	1·50±0·40	27·5–36·5	30·8–33·6	4·7
PL	36·0±0·40	1·06±0·28	32·8–39·2	33·6–36·4	2·9
Sens.	No determination.				

Loc. and Hosts. The type and 8 paratypes from a skink *Leiolopisma melanopogon* Gray, in the collection of the Queensland Museum, and collected by Dr. T. L. Bancroft, at Gregory River, N.W. Queensland in 1886.

Remarks. In the position of the sensillae bases, near to AL this species

resembles *Tr. rara* Walch, but the scutum is not quadrate as in that species. It is, however, very characteristically distinct from all other known Trombiculidae larvae in the peculiarly shaped galeal setae.

Genus HEASLIPIA Ewing 1944.

Heaslipia Ewing 1944, Proc. Biol. Soc., Washington, 57, 101–104, *nom. nov.* for *Trombiculoides* Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 101, preoc. Jacot 1938, Psyche, 45, (2–3), 122.

Genotype *Trombiculoides gateri* Wom. and Heasp. 1943 (larva).

HEASLIPIA GATERI (Wom. and Heasp. 1943).

Trombiculoides gateri Womersley and Heaslip 1943, Tr. Roy. Soc. S. Aust., 67, (1), 101, preoc. Jacot 1938, Psyche, 45, (2–3), 122.

Plate 116, fig. F–I.

Until now this species has been known only from the larva, which was described from two larvae, mounted by Gater, and recorded as from *R. rattus argentiventer* Chase, from Selinsing-Gunong, Perak, 15 Mar., 1932, and sent to the authors from the Institute for Medical Research, Kuala Lumpur.

Gater did not publish any notes on these specimens, and until now only his larval preparations were known. Quite recently, however, I have received another slide of Gater's from the I.M.R., sent to me by the Scrub Typhus Research Unit station at Kuala Lumpur, which was labelled "Nymph of *Trombiculoides gateri,* No. 293 K. Gater's slide. 29/11/32." It seems evident that Gater must have been successful in rearing at least one nymph through from an engorged larva.

Unfortunately, however, this nymph on close study revealed no characters which justify the generic separation, based on larval features, from the subgenus *Neotrombicula,* except perhaps the structure of the nasus (? epistome) which recalls that of the Leeuwenhoekiidae and may be of generic significance.

The description and figures of the nymph are as follows:

Description of Nymph. Of typical Trombiculid facies. Colour in life probably red. Length 520μ, width across propodosoma 325μ, across hysterosoma 390μ. Crista elongate, 84μ, with rather small diamond-shaped subposterior sensillary area, as figured; sensillae lost, bases 33μ apart; epistome (nasus) rather large, an elongate triangular cone, not hyaline, with ciliated epistomal seta 40μ long. Eyes absent. Chelicerae with finely serrate inner margin. Palpi normal, with 2 accessory spines at base of claw. Dorsal setae fairly uniform, to

50μ long, slender and tapering with outstanding ciliations. Legs I very slightly longer than body, and stronger than others, to 560μ long, II 390μ, III 480μ, IV 520μ; no process on tarsi I; tarsi I ovoid, 154μ long by 84μ high, metatarsi I 84μ long and as high as tarsi; sternum entire, no precoxal plates of leg I present. Genitalia 2 pairs of disks.

? SCHÖNGASTIA SAMOAENSIS sp. n.

Plate 116, fig. F–I.

Description of adult. ♀ Of typical Trombiculid facies. Colour in life unknown. Length ca. 1,430μ; width across propodosoma 650μ, across hysterosoma 780μ. Crista linear, 224μ long, with subposterior sensillary area, with SB 56μ; sensillae filamentous, ciliated distally, and to ca. 168μ long; epistome rounded-conical, dentate, 33·6μ long, with a single ciliated seta 33·6μ long. Eyes absent. Chelicerae finely ciliated on dorsal (inner) margin. Palpi normal, with 3 accessory stout spines at base of tibial claw. Dorsal setae fairly thick and ciliated, posteriorly to 34μ long. Legs I stronger and longer than rest, 845μ long, II 540μ, III 560μ, IV 715μ; tarsi I highest at about one-third, 214μ long by 114μ high, metatarsi I 143μ long; sternum entire, no precoxal plates. Genitalia with 3 pairs of disks.

Loc. A single female, collected by means of the Berlese funnel from leaf mould behind house, on Monono Is., Samoa, 22nd Dec., 1950 (coll. R. A. Harrison), and now in the collection of the Division of Scientific and Industrial Research, Auckland, New Zealand.

Remarks. This is the first Trombiculid to be recorded from Samoa, and I am indebted to Mr. K. P. Lamb, of the above Division, for the opportunity of describing it.

From the structure of the crista I believe that it is better placed as a *Schöngastia* rather than a *Trombicula*, at least until the larvae are known.

While the present work has been going through the press the following three species of larval Trombiculidae have been described from Japan by Dr. Manabu Sasa, of the Institute of Infectious Diseases, Tokyo.

Although it has not been possible to get the whole of the Japanese text translated into English, the figures enable one to judge the essential specific features and to compare the species with others from Japan and elsewhere. The species *T. nagayoi* and *T. mitamurai* will probably, when nymphs or adults become known, belong to the genus *Tragardhula*, while *T. burnsi* will be placed in the subgenus *Leptotrombidium*.

? TRAGARDHULA NAGAYOI (Sasa 1950).

Trombicula nagayoi Sasa 1950, "Studies in Tsutsugamushi," Pt. 5; Tokyo Ishi Shinshi, 67, (12), 14 (in Japanese).

Plate 117, fig. A–B; 118, fig. D–E.

Larvae. Shape ovoid. Scutum roughly pentagonal, finely pitted, with SB in front of line of PL; scutal setae rather thick and shortly ciliated, PL the longest, AL the shortest; sensillae ciliated on distal third. Eyes ? Palpi stout, with bifurcate tibial claw; setae on femur and genu branched, on tibia only the ventral branched. Galeal setae nude. Dorsal setae 2.8.10.10.8.4.4. = 46. VS. 2.2.8.6.6.4.2.2. = 32. Coxae all 1-setose. Tarsi of leg III with 1 long nude seta, metatarsi without.

Standard Data (after Sasu) AW 72, PW 89, SB 30, ASB 27, PSB 29, SD 56, A–P 31, AM 45, AL 41, PL 57, Sens. 75.

Remarks. This species was described from *Microtus montebelli* (Milne Edwards) and *Apodemus speciosus* (Temminck and Schlegel).

It is very closely related to *Trag. japonica* (Tanaka 1930), only differing in the greater number of DS, the single humeral seta on each side, and slightly in the Standard Data.

? TRAGARDHULA MITAMURAI (Sasa 1950).

Trombicula mitamurai Sasa 1950, "Studies in Tsutsugamushi," Pt. 4; Nov. 48, Tokyo Ishi Shinshi, 67, (11), 17 (in Japanese).

Plate 117, fig. C–D; 118, fig. F–G.

Larvae. Shape ovoid. Scutum roughly pentagonal with SB slightly behind line of PL; scutal setae stout with ciliations, about subequal in length; sensillae with 3 branches in idstal half. Eyes ? Palpi stout, with trifurcate tibial claw; setae on femur and genu strongly branched; on tibia dorsal and ventral strongly branched, lateral with 1 branch. Galeal setae branched. Dorsal setae 2.12.10.8.8.6.4 = 50. VS. 2.2.11.8.8.6.4.2. = 43. Coxae all 1-setose. Tarsi of leg III with 3 long nude seta, metarsi with 1 such.

Standard Data (after Sasu), AW 59·0–61·5, PW 82·0–84·5, SB 25·0–26·0, ASB 30·0–31·0, PSB 29·0–30·0, SD 60·0–60·5, A–P 25·0–26·0, AM 48·0, AL 52·5–54·5, PL 58·0, Sens. 81·0.

Remarks. This species was described from *Urotrichus talpoides hondonis* Thomas.

It is close to *Trag. tamiyai* (Philip and Fuller 1950) in having all the setae on palpal tibia branched but would appear to differ in the number of DS and the Standard Data. It may, however, be the same species.

TROMBICULA (? LEPTOTROMBIDIUM) BURNSI (Sasa, 1950).

Trombicula burnsi Sasa Oct., 1950, "Studies in Tsutsugamushi," Pt. 2; Tokyo Ishi Shinshi, 67, (10), 22 (in Japanese).

Plate 118, A–C.

Larvae. Shape ovoid. Scutum rectangular, very coarsely pitted, with SB only slightly behind line of PL and PL almost midway between the broadly rounded postero-lateral corners and AL; scutal setae very stout and strongly dentate or ciliated, subequal in length; AM situated midway between lines of AL and SB; sensillae finely barbed on basal half, ciliated distally. Eyes ? Palpi stout with trifurcate tibial claw; all setae except dorsal tibial nude. Galeal setae ? Dorsal setae rather short, stout and as the scutal setae, arranged 2.11.11.8.8.4 = 44, to 54μ. VS. ?, to 38μ. Tarsi and metatarsi of leg III without any long nude setae.

Standard Data (after Sasa), AW 70·0–79·5, PW 77·0–86·5, SB 33·0–40·5, ASB 24·5–27·5, PSB 15·0–16·5, SD 39·5–44·0, A–P 18·5–21·5, AM 43·0?–55, AL 38·0–43·0, PL 52·5–61·0, Sens. 57·0–63.

Remarks. This species was described from *Turdus celaenops* (Stejneger, It is very close in the Standard Data, and the nature of the DS to *T.* (*L.*) *pallida* (Nagayo *et al.*, 1919), but differs in the smaller number of DS, in which it approaches *T.* (*L.*) *intermedia* (Nagayo *et al.*, 1919).

TROMBICULA SCHMITZI Oudemans 1914.

Microtrombidium schmitzi Oudemans 1914, Entom. Ber., 4, (77), 87; *idem* 1916, Tijds. v. Entom., 59, 12.

Text fig. 3.

This species has been overlooked in the main part of this work, hence its inclusion in the Appendix. It was described by Oudemans from material collected by P. Assmuth from bats at Kandala (Bombay), India.

Description (after Oudemans). Length ca. 500μ. Width (fully engorged) 530μ. Colour red. Scutum trapezoidal, length ca. 50μ, width ca. 72μ; porous; anterior margin sinuous and convex medially, lateral margins concave, posterior margin moderately deep behind PL and somewhat triangular with rounded apex; AM and AL setae in line, AL the shortest, PL the longest; sensillae filamentous and ciliated distally, bases in front of line of PL. Eyes 2 + 2, on ocular shields and posterior lens the smaller. Chelicerae not serrated. Galeal setae nude. Palpi stout, tibial claw trifurcate; setae of femur and genu branched, on tibia all three nude and the lateral and ventral rather short. Dorsal setae ca. 50μ in length, 42 in number and arranged 2.6.6.6.6.6.6

2.2. Ventrally with a pair of branched or ciliated setae on maxillae, one on each coxa, a pair between coxae I and between coxae III, and thereafter ca. 116 setae arranged 4.8.10.12.14.14.14.14.14.12, shorter than dorsal setae; on each side behind coxae III a subcutaneous porous disk. Legs all 7-segmented, tarsi I and II with dorsal sensory rod, III without any long nude setae.

The Standard Data (interpolated from Oudeman's 1916 figure) are: AW 57·5, PW 64·4, SB 21·0, ASB 27·5, PSB 24·0, SD 51·5, A–P 34·5, AM —, AL 27·5, PL 50·0, Sens. In his figure, AM is omitted and Sens. broken.

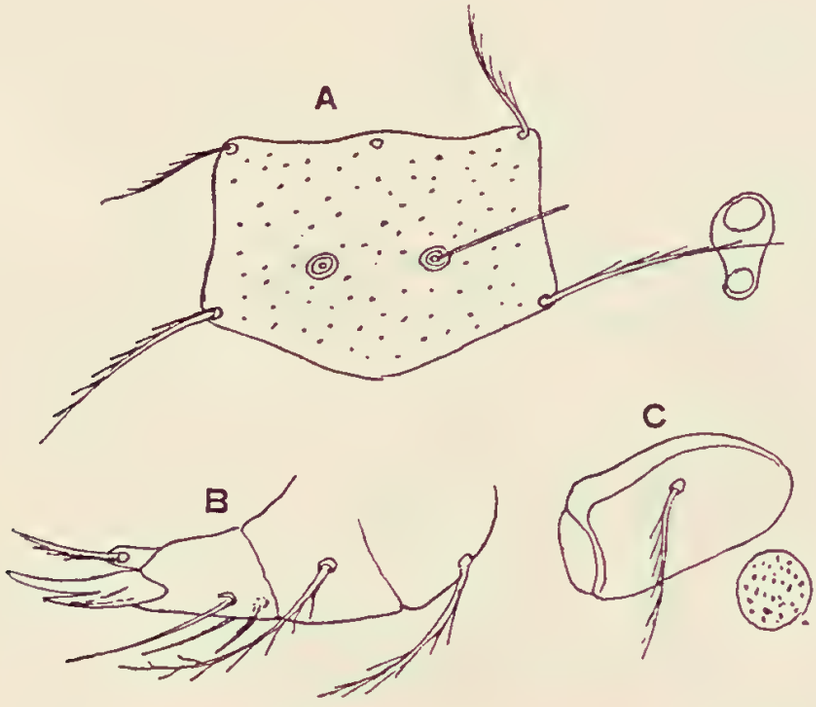

Fig. 3. A–C, *Trombicula schmitzi* Ouds. 1914: A. dorsal scutum (× 500), B. left palp in dorsal view, C. left coxa showing accessory disc. (all after Oudemans).

Remarks. It is not clear from Oudeman's 1916 paper, whether he had more than one specimen. The species has not yet been recorded since the original description, but should be easily recognized from the scutum, the dorsal and ventral setae, and the peculiar ventral porous disks. In the key given here on p. 43 it will fall into caption 60 if the scutum is regarded as pentagonal, otherwise into caption 61a on page 44.

Under caption 60 it comes nearest to *kashmirensis* sp. n. in the number of dorsal setae, but differs in their arrangement and the smaller scutum. Under 61a, it differs from both *incurva* sp. n. and *vietzi* sp. n. in the dorsal setae and the palpal setation.

CORRIGENDA.

Page 82. Delete the Standard Data given for a population of *T.* (*N.*) *rara* from pill-millipedes, and insert the following:

	Mean	Standard Deviation	Theoretical Range	Observed Range	Coeff. of Variation
AW	87·6±0·62	2·31±0·44	80·7–94·5	84·0–92·4	2·6
PW	94·8±0·71	2·66±0·50	86·8–102·8	92·4–100·8	2·8
SB	59·0±0·43	1·76±0·33	53·7–64·7	56·4–61·6	3·0
ASB	21·4±0·56	2·08±0·39	15·2–27·6	19·6–25·2	9·7
PSB	53·0±0·63	2·37±0·45	45·9–60·1	50·4–53·2	4·5
SD	74·4±0·56	2·11±0·40	68·1–80·7	72·8–78·4	2·8
A–P	41·7±0·67	2·41±0·47	34·5–48·9	36·4–44·8	5·8
AM	43·9±0·93	3·23±0·66	36·2–53·6	36·4–47·6	7·3
AL	38·0±0·54	1·87±0·38	32·4–43·6	33·6–39·2	4·9
PL	55·0±0·87	3·00±0·61	46·0–64·4	47·6–58·8	5·5
Sens.	58·65±1·23	3·49±0·87	48·2–69·1	53·2–61·6	5·9

Page 219. The specific name *westraliense* was used by Womersley 1934 (Rec. S.A. Mus., 5, (2), p. 188) for an adult species of *Microtrombidium* now considered to be a *Schöngastia*, and also on p. 215 for a larval *Schöngastia*. It is therefore now proposed to substitute the name of *newmani* for the larval species, in honour of Mr. B. Newman, the late entomologist to Western Australia.

Consequently on

Page 240 in caption "60" for "*westraliense*" read "*newmani* nom. nov."

Page 405 in the list of species insert "*Schöngastia* (*Ascoschöngastia*) *newmani* nom. nov." between *phascogale* and *peregrina*.

Page 407 in Summary for "254" read "255", and for "221" read "222".

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RECORDS

OF THE

SOUTH AUSTRALIAN MUSEUM

VOLUME X

THE SCRUB-TYPHUS AND SCRUB-ITCH MITES (*TROMBICULIDAE*, ACARINA) OF THE ASIATIC-PACIFIC REGION

PART 2 (PLATES)

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PLATE 1.

A–D. *Tragardhula acuscutellaris* (Walch 1922). A, scutum (× 500); B, palp; C, tip of chelicera; D, tarsus and metatarsus of leg III.

E–H. *Tragardhula japonica* (Tanaka, 1930). E, scutum (× 500); F, palp; G, tip of chelicera; H, tarsus and metatarsus of leg III.

I–M. *Tragardhula tamiyai* (Philip and Fuller 1950). I, scutum (× 500); J, palp; K, tip of chelicera; L, galeal seta; M, tarsus and metatarsus of leg III.

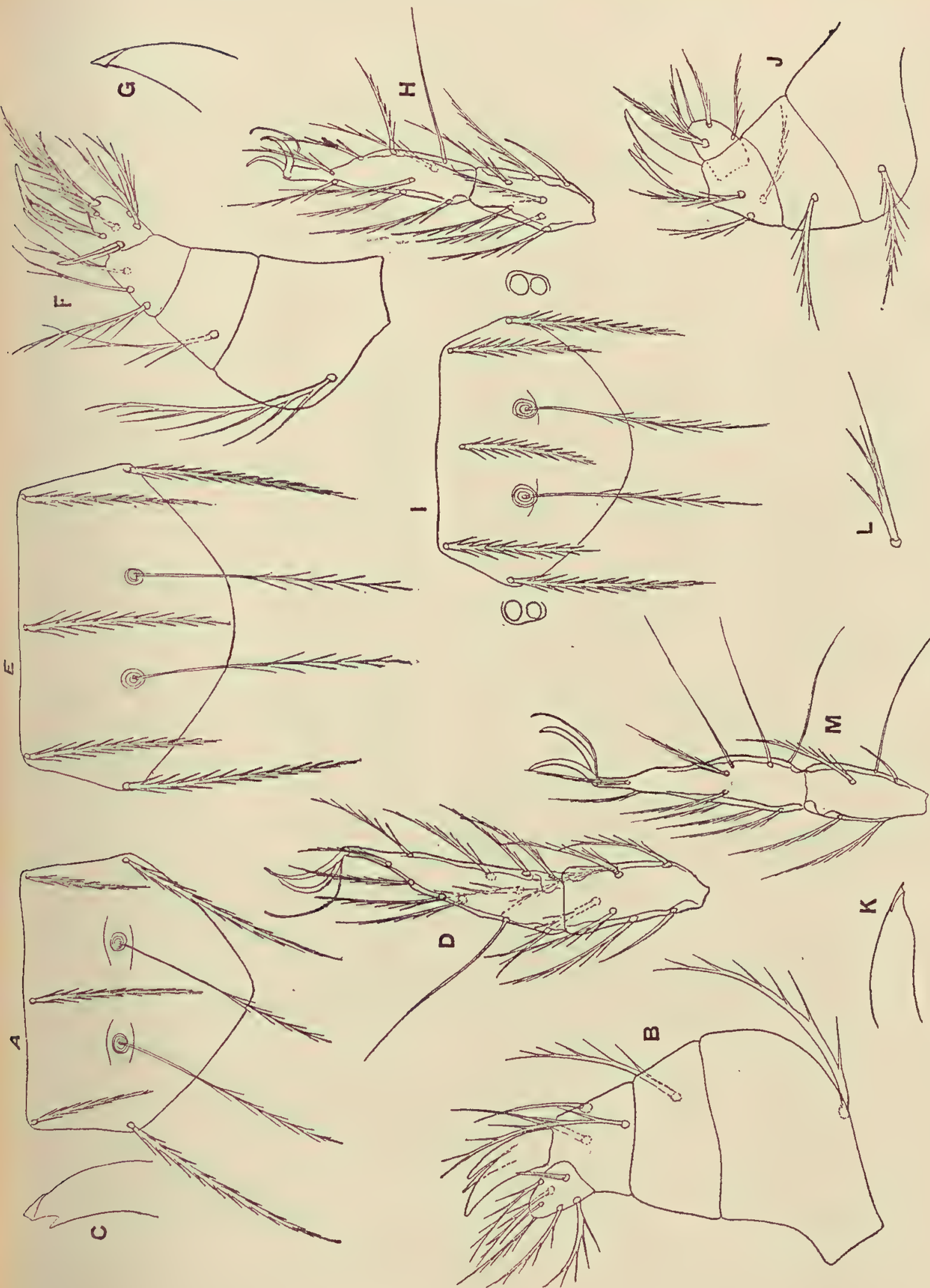

PLATE 1.

PLATE 2.

A–C. *Tragardhula fujigmo* (Philip and Fuller 1950). A, scutum (× 500); B, palp; C, tarsus and metatarsus of leg III.

D–E. *Tragardhula geckobia* sp. n. D, scutum (× 500); E, palp, tip of chelicera and galeal seta.

F–I. *Tragardhula pentagona* sp. n. F, scutum (× 500); G, palp; H, tip of chelicera; I, tarsus and metatarsus of leg III.

J–M. *Tragardhula gymnodactyla* (Wom. and Kohls, 1947). J, scutum, (× 500); K, palp; L, tip of chelicera; M, tarsus and metatarsus of leg III.

PLATE 2.

PLATE 3.

A–F. *Trombicula* (*Leptotrombidium*) *palpalis* (Nagayo *et al.*, 1919). A, scutum (× 500); B, palp; C, tip of chelicera; D, galeal seta; E, tarsus and metatarsus of leg III; F, dorsal seta.

G–J. *Trombicula* (*? Leptotrombidium*) *keukenschrijveri* Walch 1923. G, scutum (× 500); H, palp; I, tip of chelicera and galeal seta; J, dorsal seta.

K–P. *Trombicula* (*Leptotrombidium*) *pallida* (Nagayo *et al.*, 1919). K, scutum (× 500); L, palp; M, tip of chelicera; N, tarsus and metatarsus of leg III; O, galeal seta; P, dorsal seta.

Q. *Trombicula* (*Leptotrombidium*) *intermedia* (Nagayo *et al.*, 1920). Q, scutum (× 500), (after Kuwato, Berge and Philip, 1950).

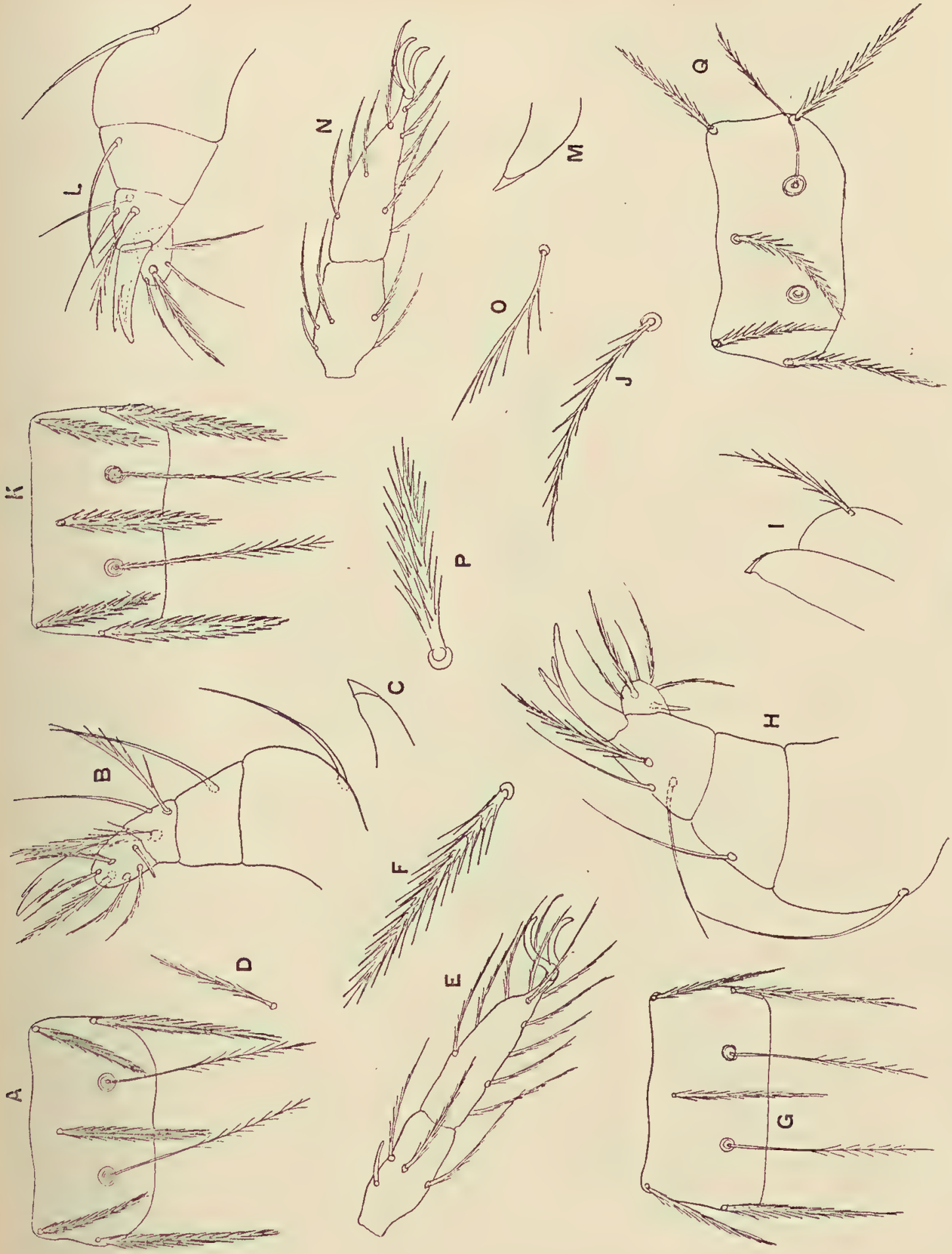

PLATE 3.

PLATE 4.

A–C. *Trombicula* (*? Leptotrombidium*) *fuji* Kuwato, Berge and Philip, 1950. A, dorsal right half and left ventral half views; B, scutum (× 500); C, palp (after Kuwato *et al.*).

D–I. *Trombicula* (*? Leptotrombidium*) *lanceolata* sp. n. Lawrence, T. J. D, dorsal view; E, ventral view; F, scutum (× 500); G, chelicera and galeal seta; H, palp; I, dorsal seta.

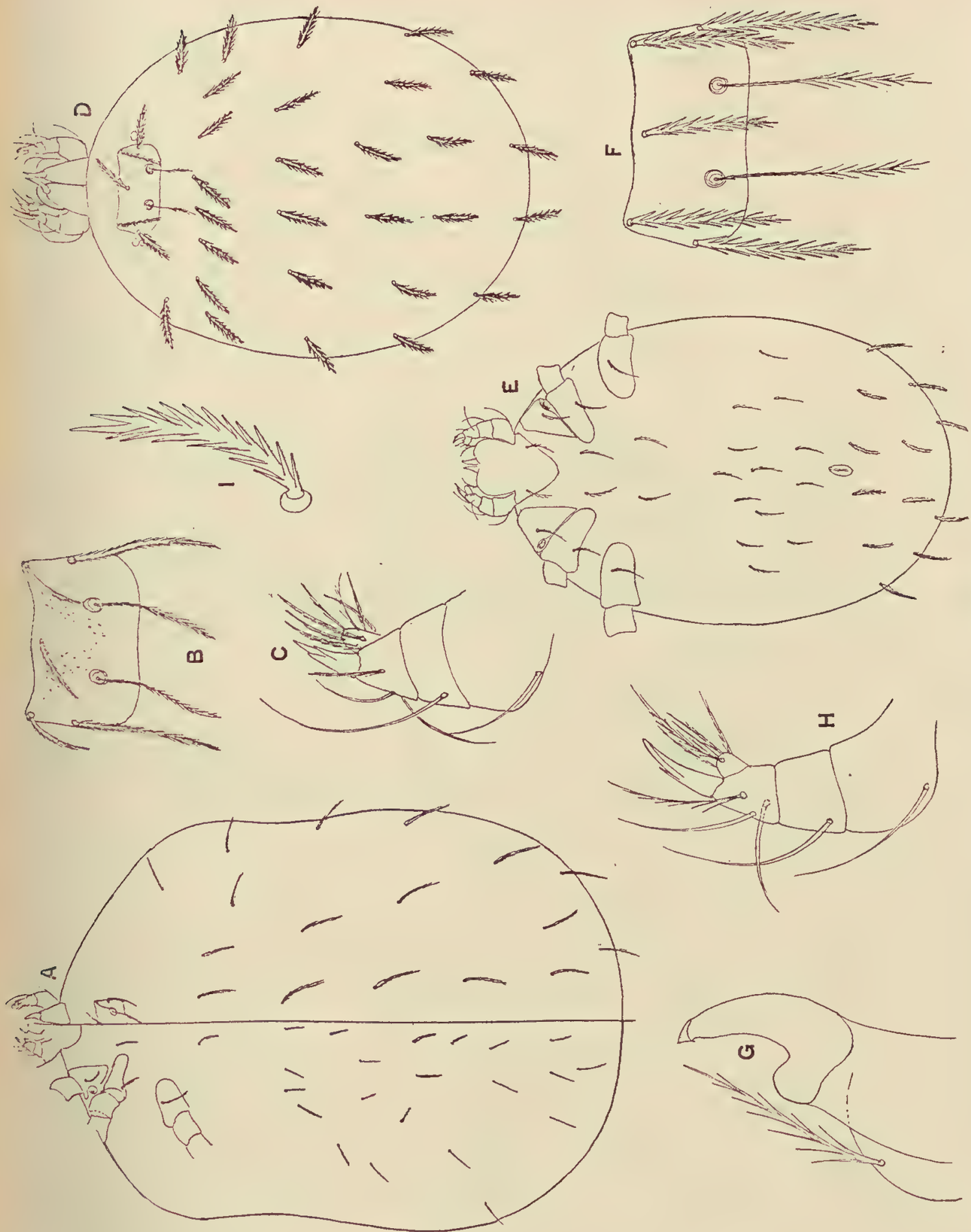

PLATE 4.

PLATE 5.

A–F. *Trombicula* (? *Leptotrombidium*) *macacus* sp. n. Lawrence, T. J. A, dorsal view; B, ventral view; C, scutum (× 500); D, tip of chelicera and galeal seta; E, palp; F, dorsal seta.

G–L. *Trombicula* (? *Leptotrombidium*) *dux* sp. n. G, dorsal view; H, ventral view; I, scutum (× 500); J, tip of chelicera and galeal seta; K, palp; L, dorsal seta.

PLATE 5.

PLATE 6.

A–E. *Trombicula* (? *Leptotrombidium*) *scutellaris* (Nagayo *et al.*, 1920). A, scutum (× 500); B, palp; C, tip of chelicera and galeal seta; D, dorsal seta; E, tarsus and metatarsus of leg III.

F–H. *Trombicula* (*Leptotrombidium*) *deliensis* Walch 1923. F, scutum (× 500); G, galeal seta; H, dorsal seta.

I–L. *Trombicula* (*Leptotrombidium*) *deliensis* f. *bunaensis* nov. I, dorsal view; J, scutum (× 500); K, palp; L, tip of chelicera and galeal seta.

M–O. *Trombicula* (*Leptotrombidium*) *akamushi* (Brumpt, 1910). M, scutum (× 500); N, galeal seta; O, dorsal seta.

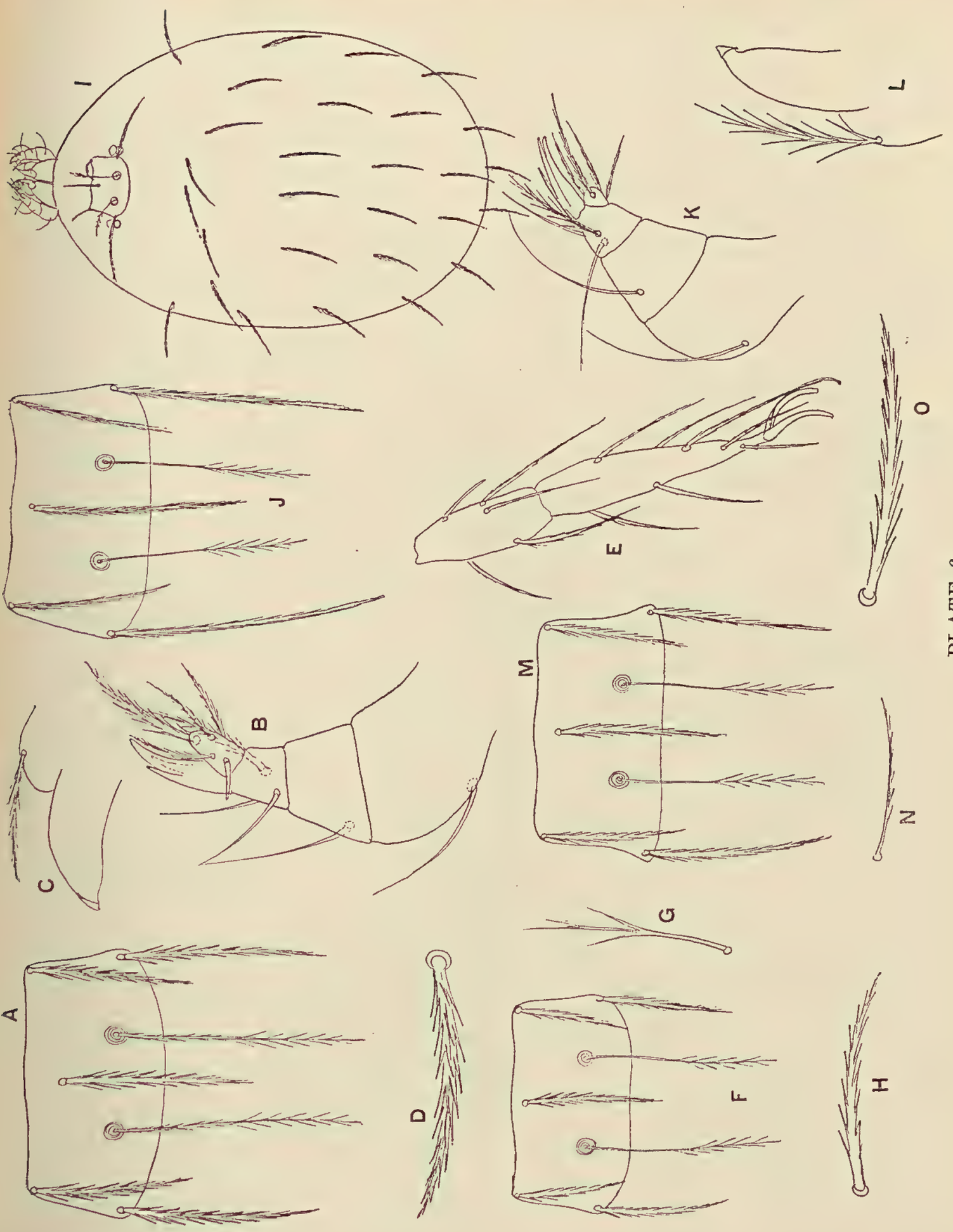

PLATE 6.

PLATE 7.

A–E. *Trombicula* (? *Leptotrombidium*) *villosa* sp. n. A, dorsal view; B, ventral view; C, scutum (× 500); D, chelicera; E, palp.

F–I. *Trombicula bhimtalensis* sp. n. F, dorsal view; G, ventral view; H, scutum (× 500); I, palp.

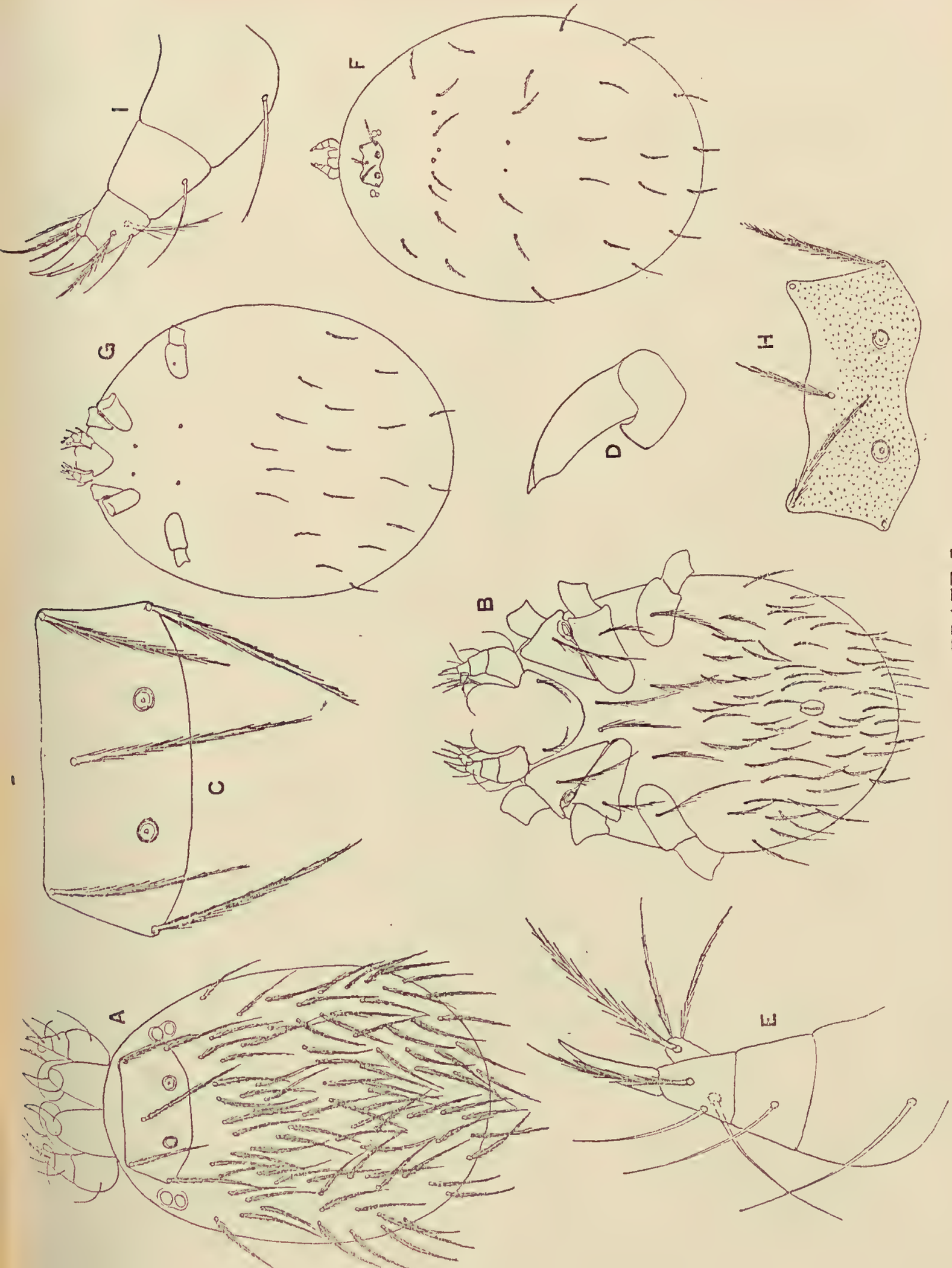

PLATE 7.

PLATE 8.

A–E. *Trombicula* (? *Leptotrombidium*) *longiseta* sp. n. A, dorsal view; B, ventral view; C, scutum (× 500); D, chelicera and galeal seta; E, palp.

F–J. *Trombicula* (*Leptotrombidium*) *fulleri* (Ewing 1945). F, dorsal view; G, ventral view; H, scutum (× 500); I, palp; J, chelicera and galeal seta.

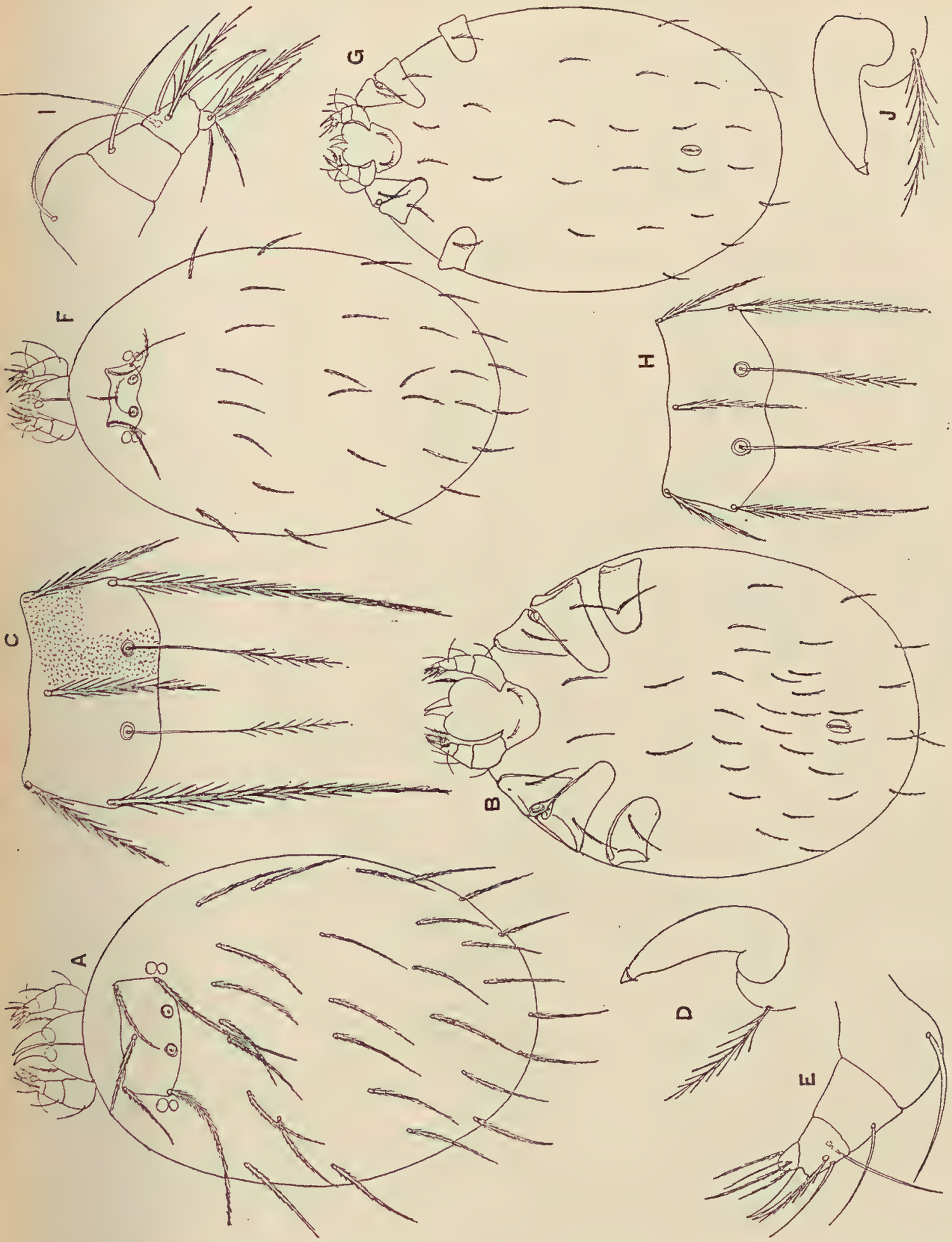

PLATE 8.

PLATE 9.

A–C. *Trombicula* (*Leptotrombidium*) *myzantha* sp. n. A, scutum (× 500); B, palp; C, tip of chelicera.

D–F. *Trombicula* (? *Leptotrombidium*) *robusta* Gunther, 1941. D, scutum (× 500); E, palp; F, tip of chelicera.

G–K. *Trombicula* (*Leptotrombidium*) *burmensis* (Ewing, 1945). G, dorsal view; H, ventral view; I, scutum (× 500); J, palp; K, chelicera and galeal seta.

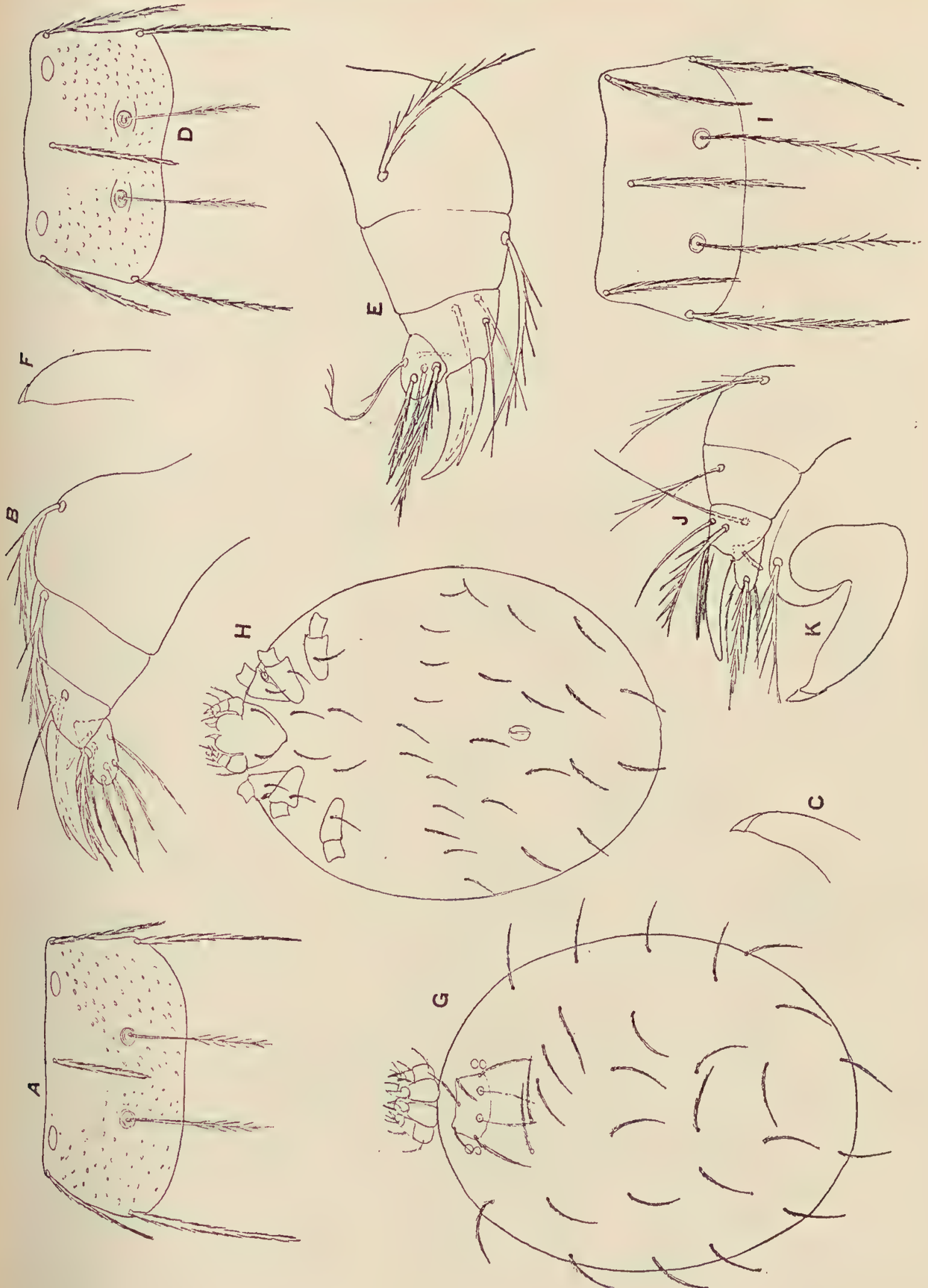

PLATE 9.

PLATE 10.

A–E. *Trombicula parapalpalis* sp. n. A, left half in dorsal view; B, right half in ventral view; C, scutum (× 500); D, palp; E, dorsal seta.

F–J. *Trombicula puta* sp. n. F, left half in dorsal view; G, right half in ventral view; H, scutum (× 500); I, palp; J, dorsal seta.

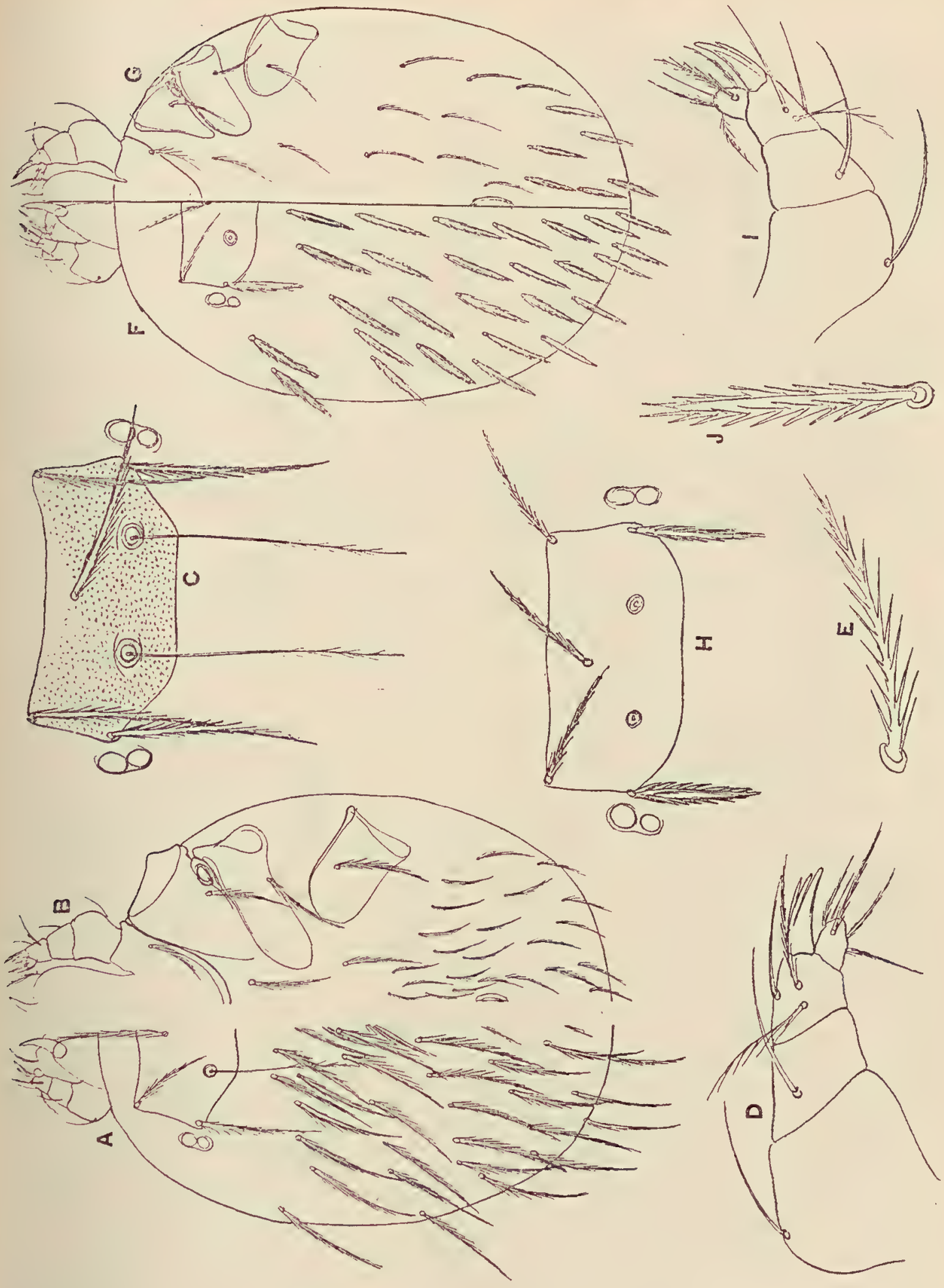

PLATE 10.

PLATE 11.

A–F. *Trombicula* (*Neotrombicula*) *fordi* sp. n. Lawrence, T. J. A, right half in dorsal view; B, left half in ventral view; C, scutum (× 500); D, dorsal seta; E, palp; F, tip of chelicera and galeal seta.

G–K. *Trombicula* (*? Neotrombicula*) *traubi* sp. n. G, right half in dorsal view; H, left half in ventral view; I, scutum (× 500); J, palp; K, dorsal seta.

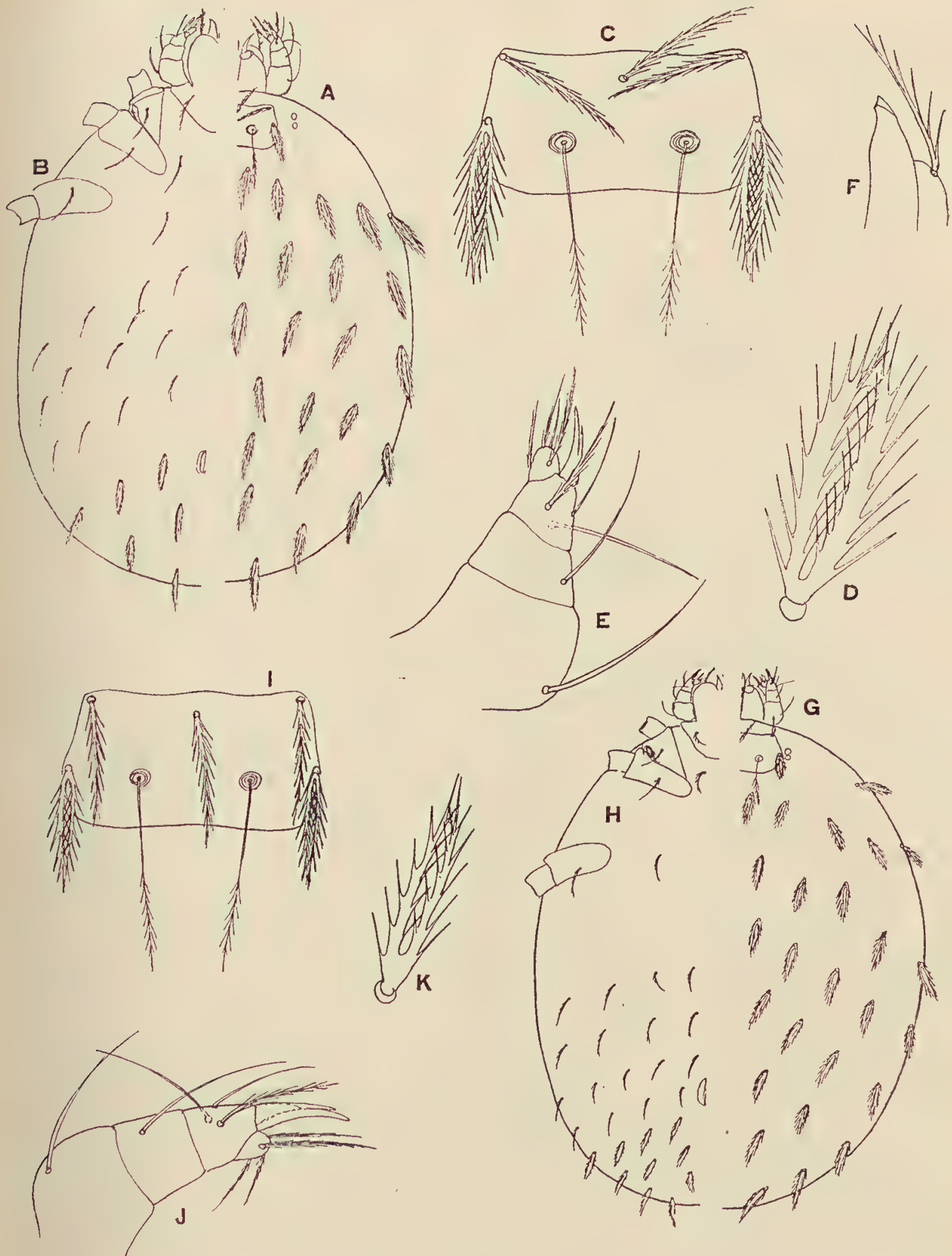

PLATE 11.

PLATE 12.

A–E. *Trombicula* (*Neotrombicula*) *hastata* (Gater 1932). A, dorsal view (after Gater); B, ventral view (after Gater); C, scutum (× 500); D, tip of chelicera and galeal seta; E, palp.

F–I. *Trombicula novae-hollandiae* Hirst, 1929. F. scutum (× 500); G, palp; H, tip of chelicera and galeal seta; I, tarsus and metatarsus of leg III.

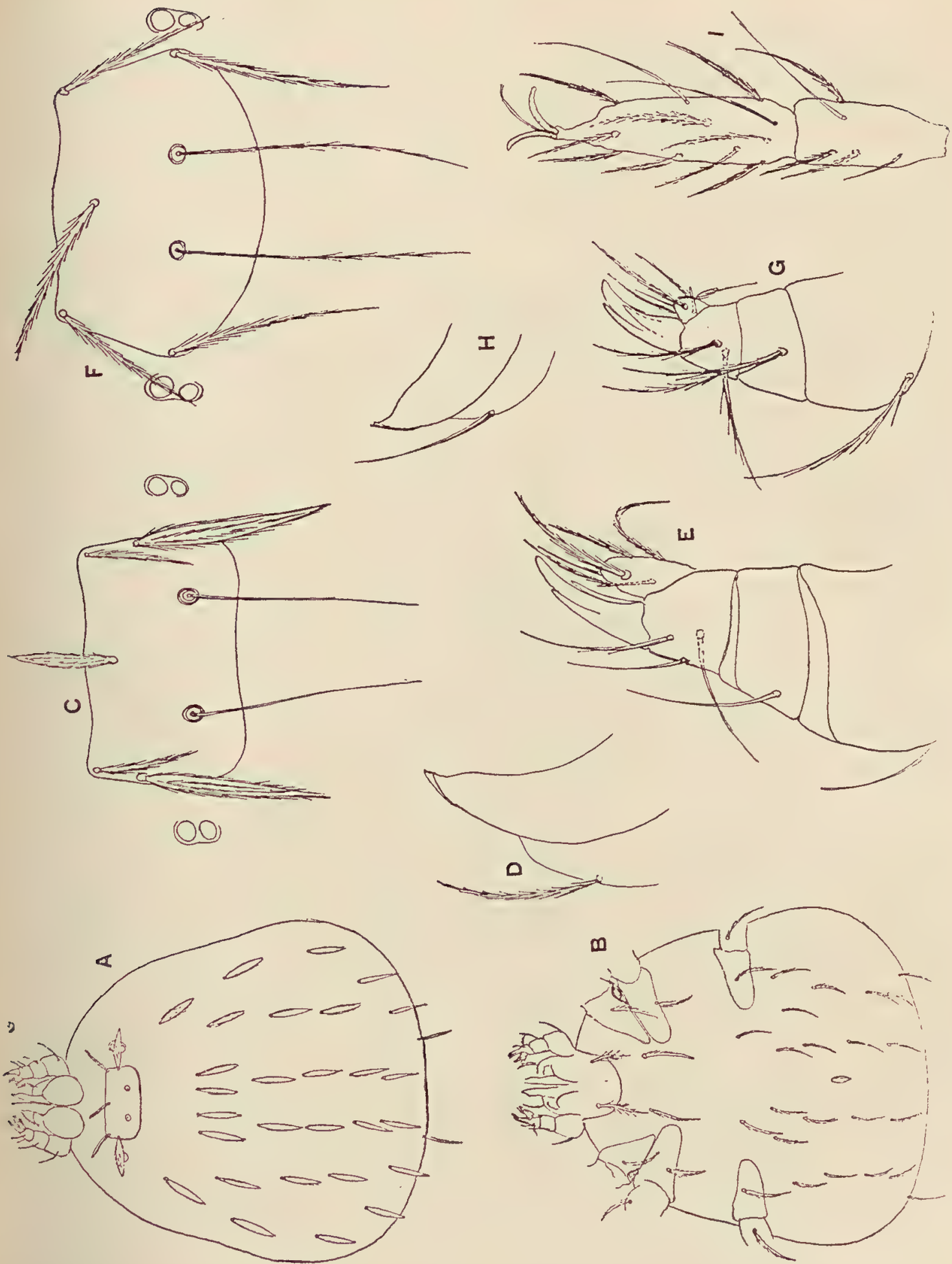

PLATE 12.

PLATE 13.

A–D. *Trombicula* (*Neotrombicula*) *rara* (Walch 1923). A, scutum (× 500); B, palp; C, tip of chelicera; D, tarsus and metatarsus of leg III.

E–I. *Trombicula hirsti* Sambon, 1927. E, scutum (× 500); F, palp; G, tip of chelicera; H, galeal seta; I, tarsus and metatarsus of leg III.

J–L. *Trombicula sobrina* sp. n. J, scutum (× 500); K, palp; L, tarsus and metatarsus of leg III.

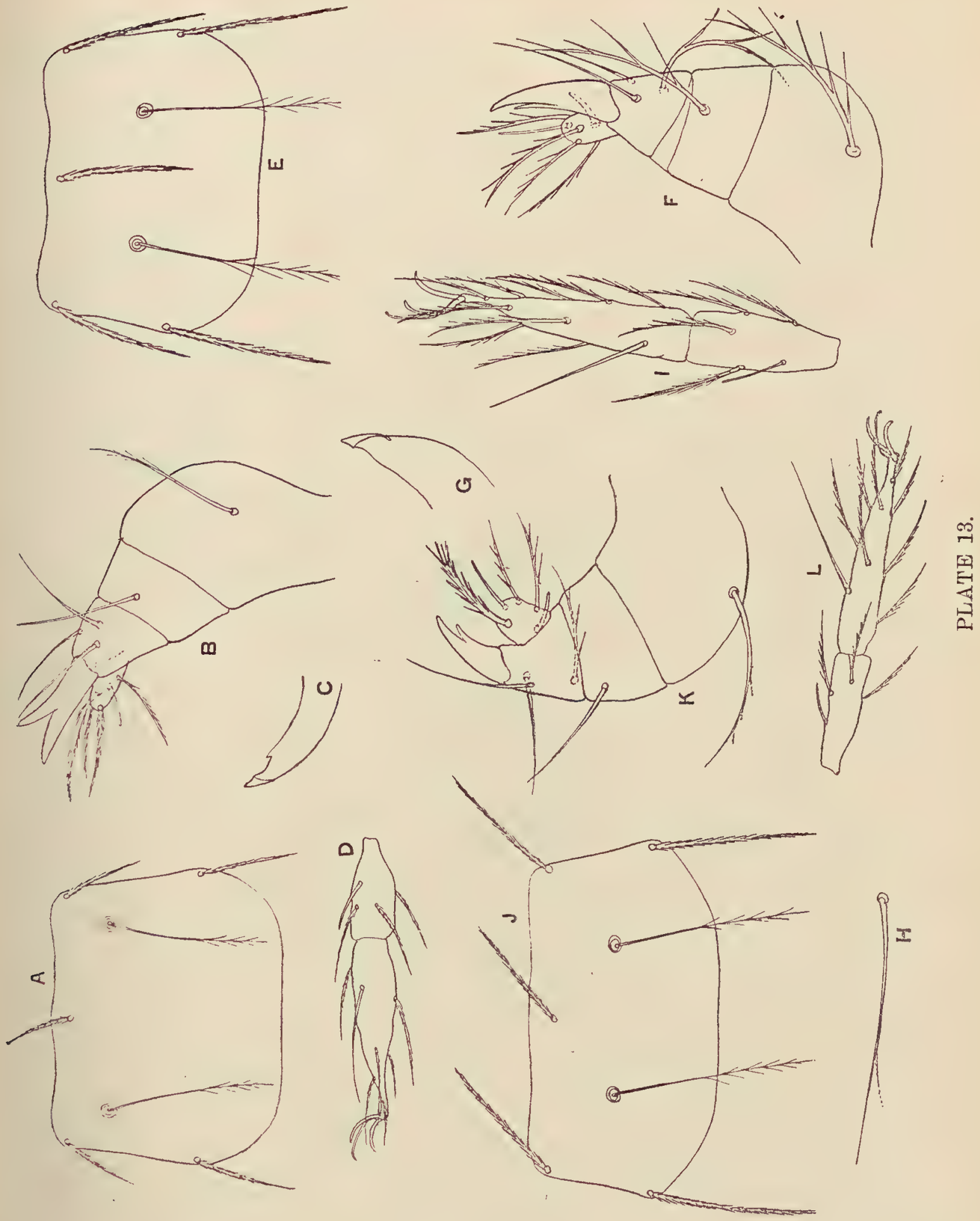

PLATE 13.

PLATE 14.

A–C. *Trombicula ablephara* sp. n. A, scutum (× 500); B, palp; C, tarsus and metatarsus of leg III.

D–G. *Trombicula* (*Trombicula*) *wichmanni* (Ouds., 1905). D, scutum (× 500); E, palp; F, tip of chelicera; G, tarsus and metatarsus of leg III.

H–J. *Trombicula anous* (Wharton, 1946). H, scutum (× 500); I, palp; J, tip of chelicera.

K–M. *Trombicula pluvius* (Wharton, 1946). K, scutum (× 500); L, palp; M, tip of chelicera.

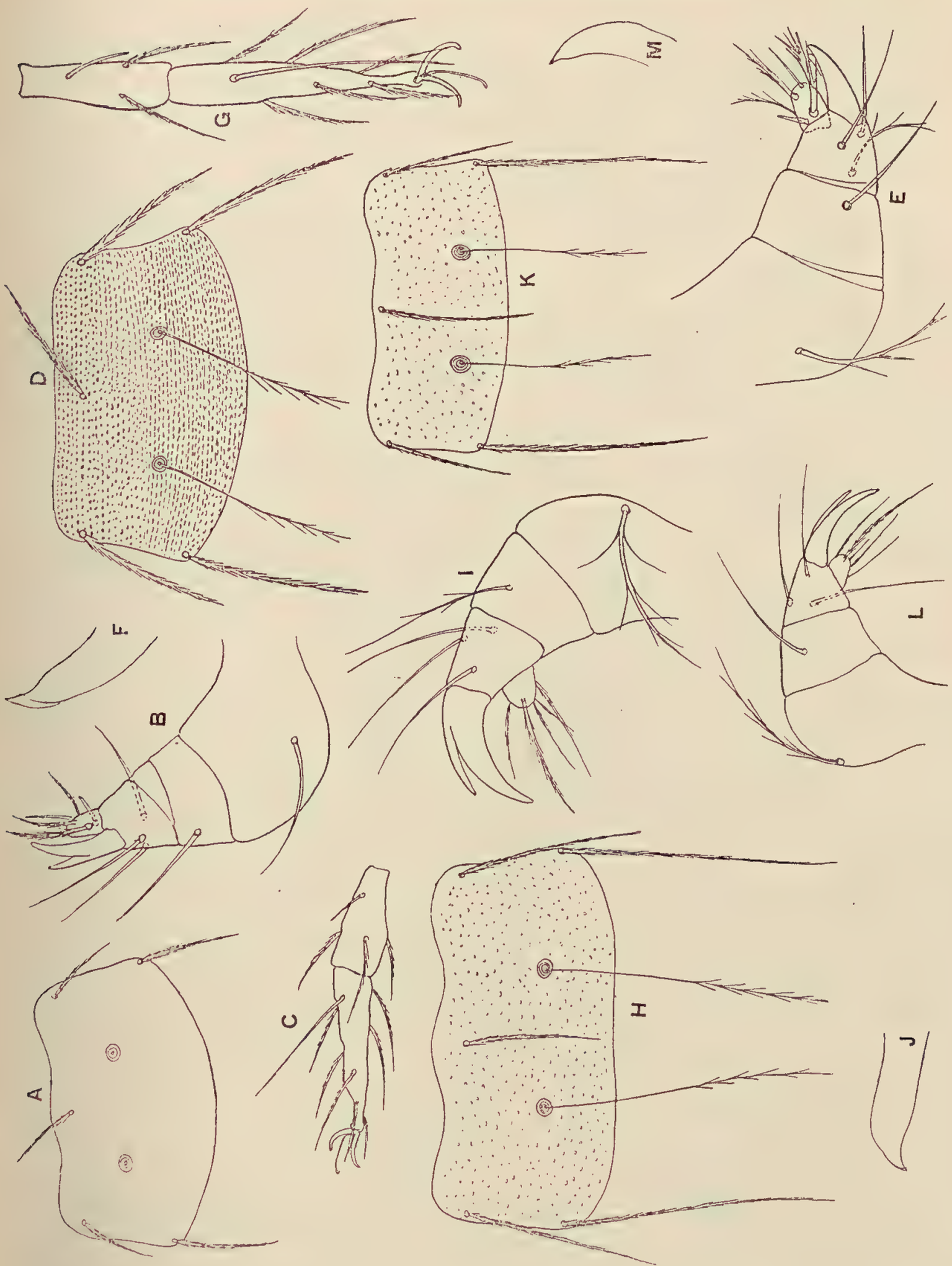

PLATE 14.

PLATE 15.

A–D. *Trombicula lygosomoides* sp. n. A, scutum (× 500); B, palp; C, tip of chelicera; D, tarsus and metatarsus of leg III.

E–H. *Trombicula* (*Trombicula*) *samboni* Wom. 1939. E, scutum (× 500); F, palp; G, tip of chelicera; H, tarsus and metatarsus of leg III.

I–L. *Trombicula* (*Neotrombicula*) *sarcina* (Wom. 1944). I, scutum (× 500); J, palp; K, tip of chelicera; L, tarsus and metatarsus of leg III.

PLATE 15.

PLATE 16.

A–D. *Trombicula macropus* Wom. 1936. A, scutum (× 500); B, palp; C, tip of chelicera; D, tarsus and metatarsus of leg III.

E–H. *Trombicula rioi* Gunther, 1939. E, scutum (× 500); F, palp; G, tip of chelicera; H, tarsus and metatarsus of leg III.

I–L. *Trombicula* (*Fonsecia*) *coluberina* (Radford, 1946). I, scutum (× 500); J, palp; K, tip of chelicera; L, dorsal seta.

PLATE 16.

PLATE 17.

A–C. *Trombicula batui* Philip and Traub, 1950. A, right dorsal and left ventral views; B, scutum (× 500); C, palp (after Philip and Traub).

D–F. *Trombicula* (*? Neotrombicula*) *munda* (Gater, 1932). D, scutum (× 500); E, palp; F, tip of chelicera.

G–I. *Trombicula* (*Neotrombicula*) *spicea* (Gater, 1932). G, scutum (× 500); H, palp; I, tip of chelicera.

J–M. *Trombicula parmifera* sp. n. J, dorsal view; K, scutum (× 500); L, palp; M, chelicera.

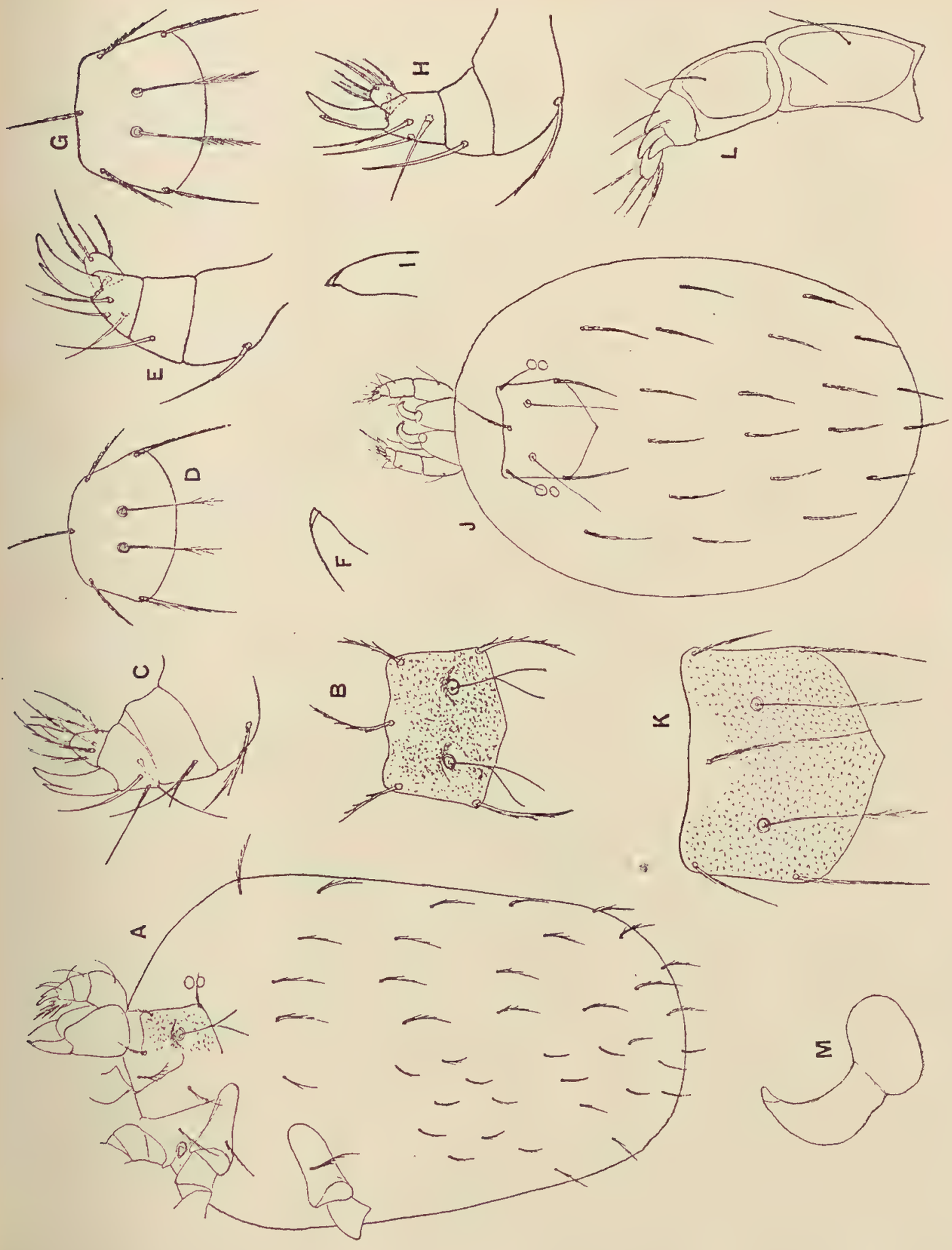

PLATE 17.

PLATE 18.

A–D. *Trombicula lundbladi* sp. n. A, right dorsal and left ventral view; B, palp; C, tip of chelicera; D, scutum (× 500).

E–H. *Trombicula* (*Leptotrombidium*) *bodensis* (Gunther, 1940). E, scutum (× 500); F, palp; G, tip of chelicera; H, galeal seta.

I–K. *Trombicula nissani* Dumbleton, 1947. I, scutum and eyes (× 500); J, palp; K, tip of chelicera.

L–M. *Trombicula isshikii* Sugimoto, 1938. L, scutum (× 500); M, palp (after Sugimoto).

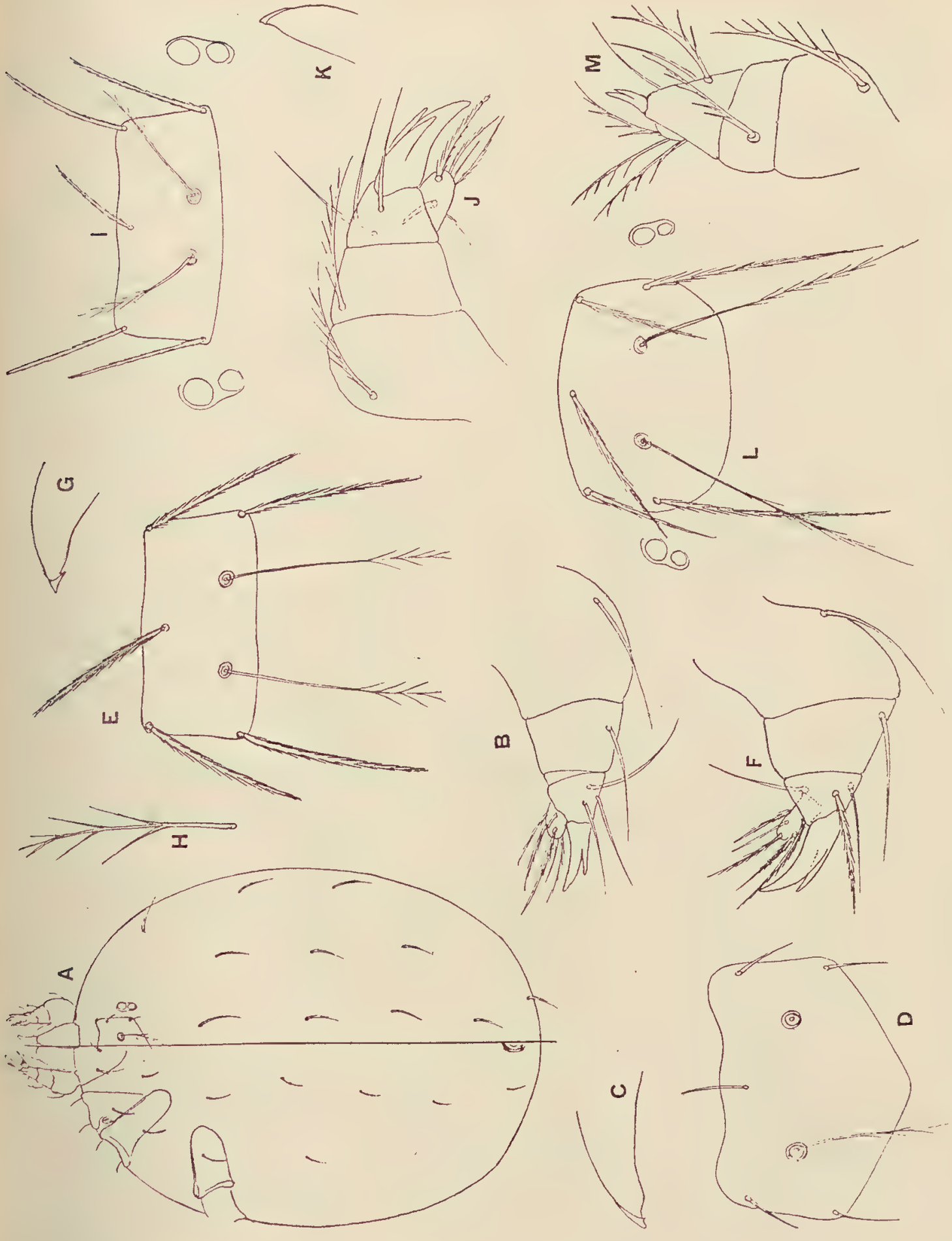

PLATE 18.

PLATE 19.

A–E. *Trombicula* (*Neotrombicula*) *scincoides* (Wom., 1944). A, scutum (× 500); B, palp; C, tip of chelicera; D, scutum of form from Hollandia (× 500); E, tarsus and metatarsus of leg III.

F–G. *Trombicula* (*? Neotrombicula*) *kohlsi* (Wom., 1944). F, scutum (× 500); G, palp.

H–J. *Trombicula* (*? Neotrombicula*) *tovelli* sp. n. H, scutum (× 500); I, palp; J, tip of chelicera.

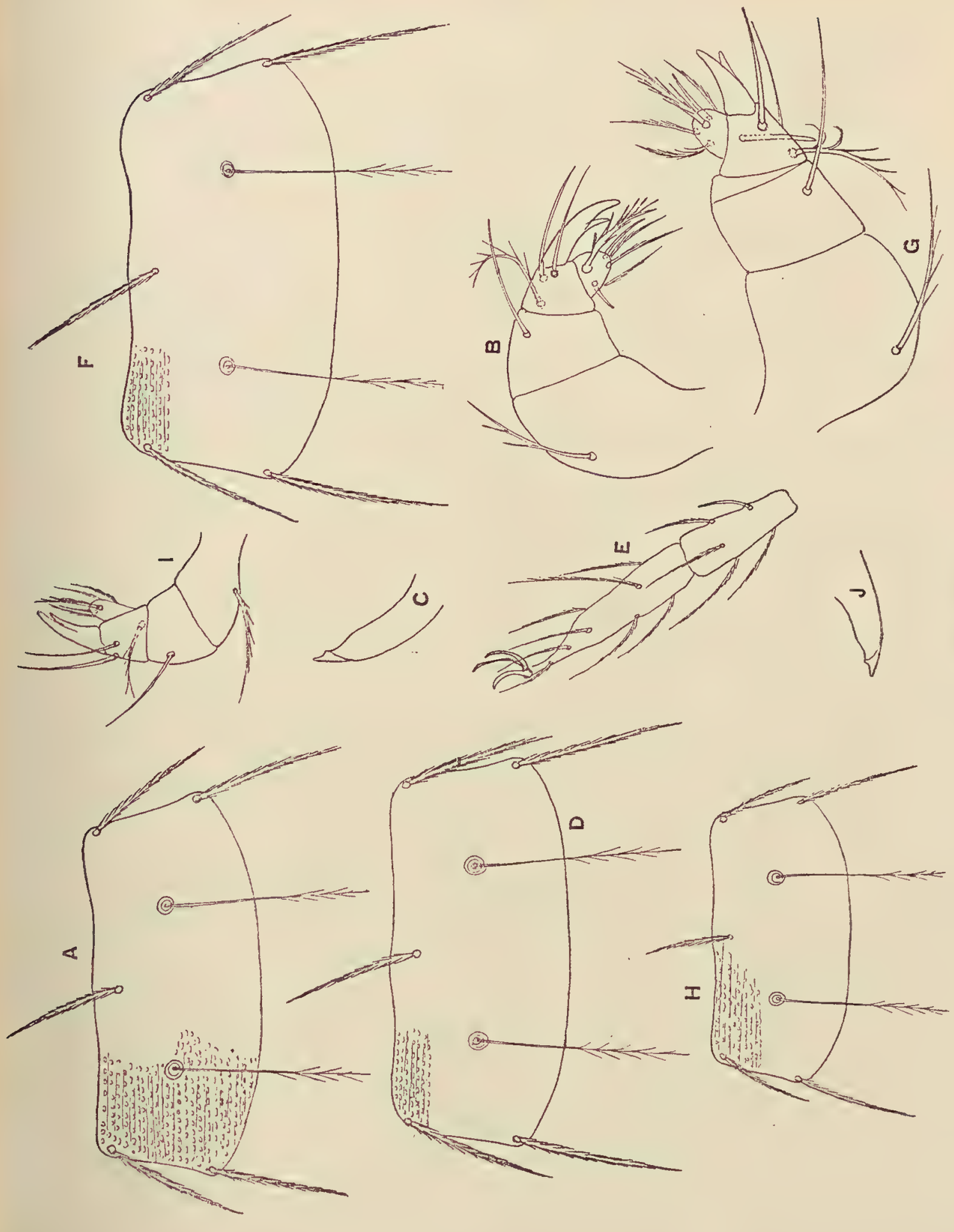

PLATE 19.

PLATE 20.

A–B. *Trombicula jubbulporensis* sp. n. A, scutum (× 500); B, palp.

C–D. *Trombicula khurdangensis* sp. n. C, scutum (× 500); D, palp.

E–F. *Trombicula kashmirensis* sp. n. E, scutum (× 500); F, palp.

G–K. *Trombicula rajoriensis* sp. n. G, scutum (× 500); H, palp; I, dorsal seta; J, galeal seta; K, coxae of leg III.

L–M. *Trombicula muridia* sp. n. L, scutum (× 500); M, palp.

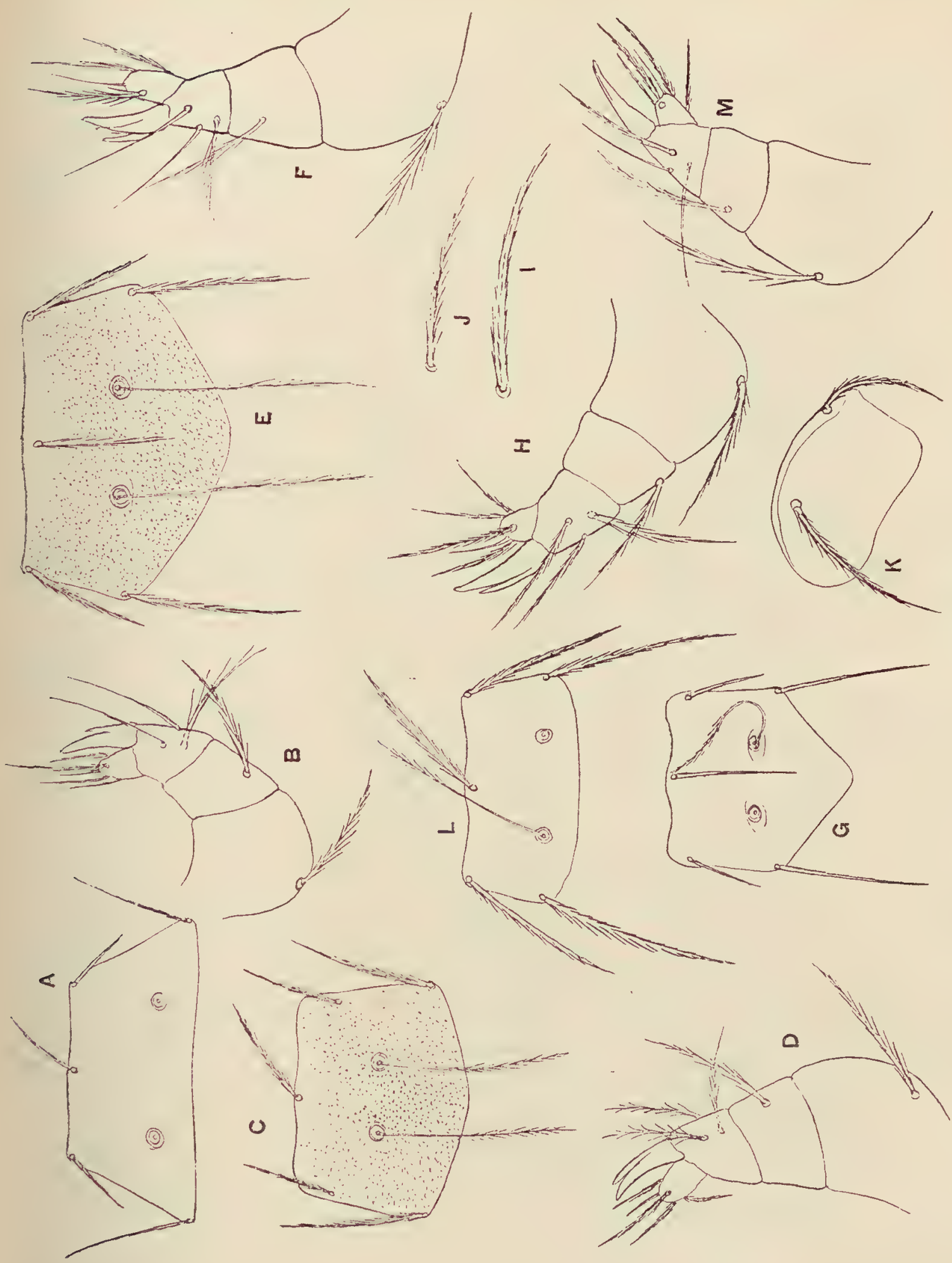

PLATE 20.

PLATE 21.

A–B. *Trombicula taphozous* sp. n. A, scutum (× 500); B, palp.

C–G. *Trombicula tithwalensis* sp. n. C, left dorsal half; D, right ventral half; E, scutum (× 500); F, palp; G. galeal seta.

H–L. *Trombicula kanzaluanensis* sp. n. H, left dorsal half; I, right ventral half; J, scutum (× 500); K, tip of chelicera and galeal seta; L, palp.

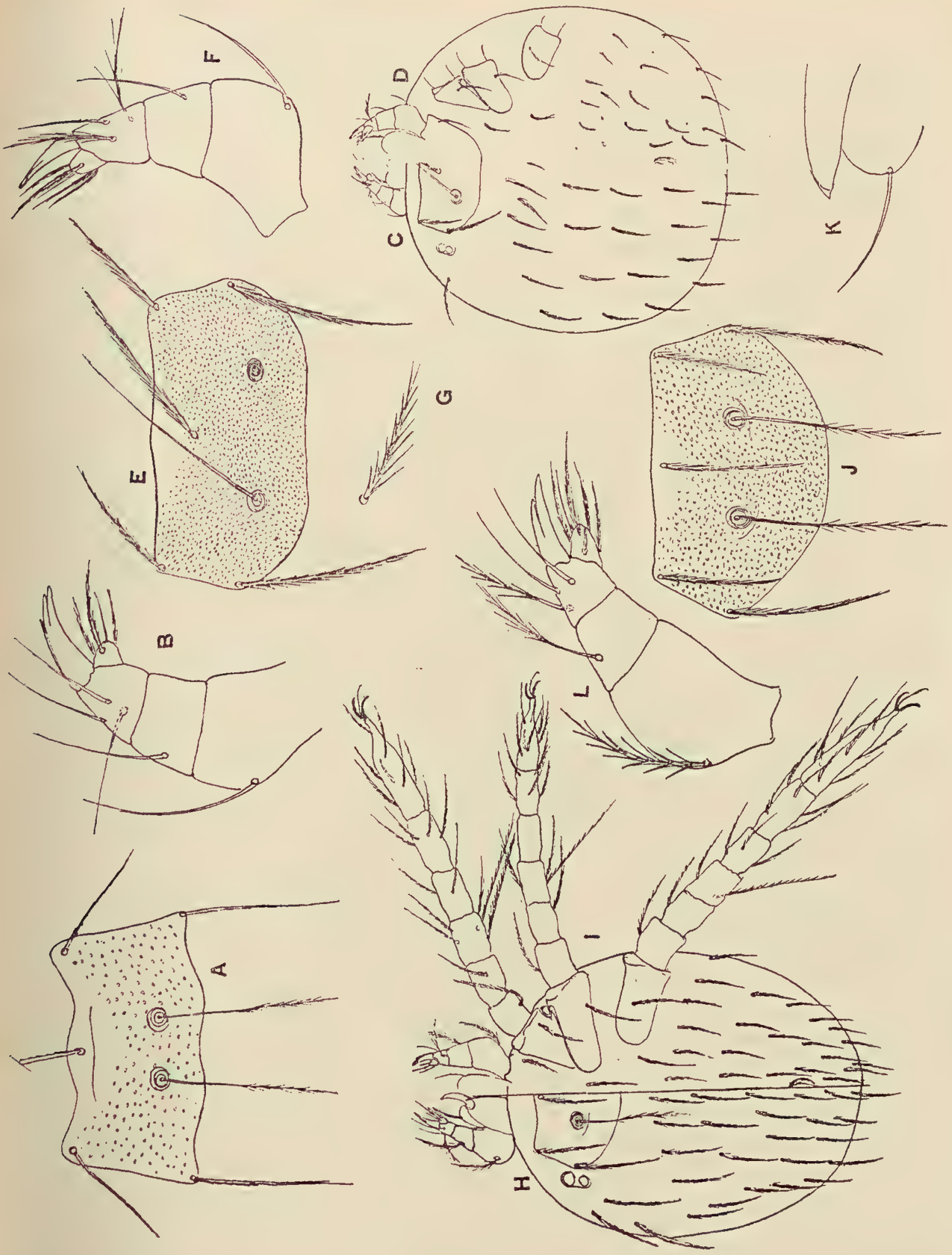

PLATE 21.

PLATE 22.

A–F. *Trombicula buxtoni* sp. n. A, ventral view; B, dorsal view; C, scutum (× 500); D, chelicera and galeal seta; E, palp; F, dorsal seta.

G–J. *Trombicula naultini* Dumbleton 1947. G, scutum (× 500); H, palp; I, tip of chelicera; J, tarsus and metatarsus of leg III.

K. *Trombicula cervulicola* Ewing, 1931. Scutum (× 500).

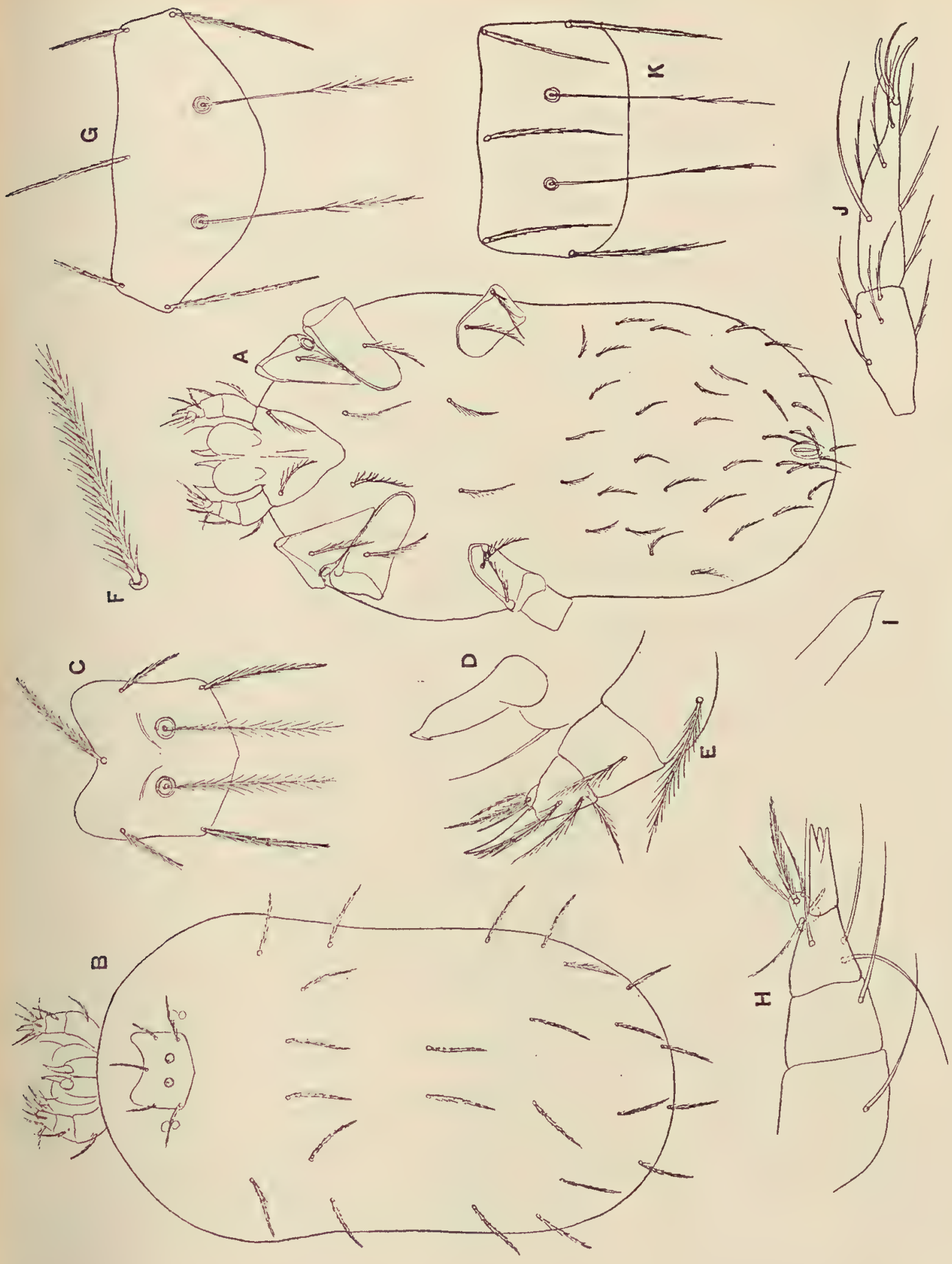

PLATE 22.

PLATE 23.

A. *Trombicula corvi* Hatori 1920. Scutum (× 500), (after Wom. and Heasp., 1943).

B–E. *Trombicula densipiliata* Walch, 1923. B, scutum (× 500); C, palp; D, tip of chelicera; E, galeal seta.

F–H. *Trombicula insolli* Philip and Traub, 1950. F, right dorsal and left ventral halves; G, scutum (× 500); H, palp.

I–L. *Trombicula* (*Trombicula*) *frittsi* Wharton, 1945. I, scutum (× 500); J, palp; K, tip of chelicera; L, tarsus and metatarsus of leg III.

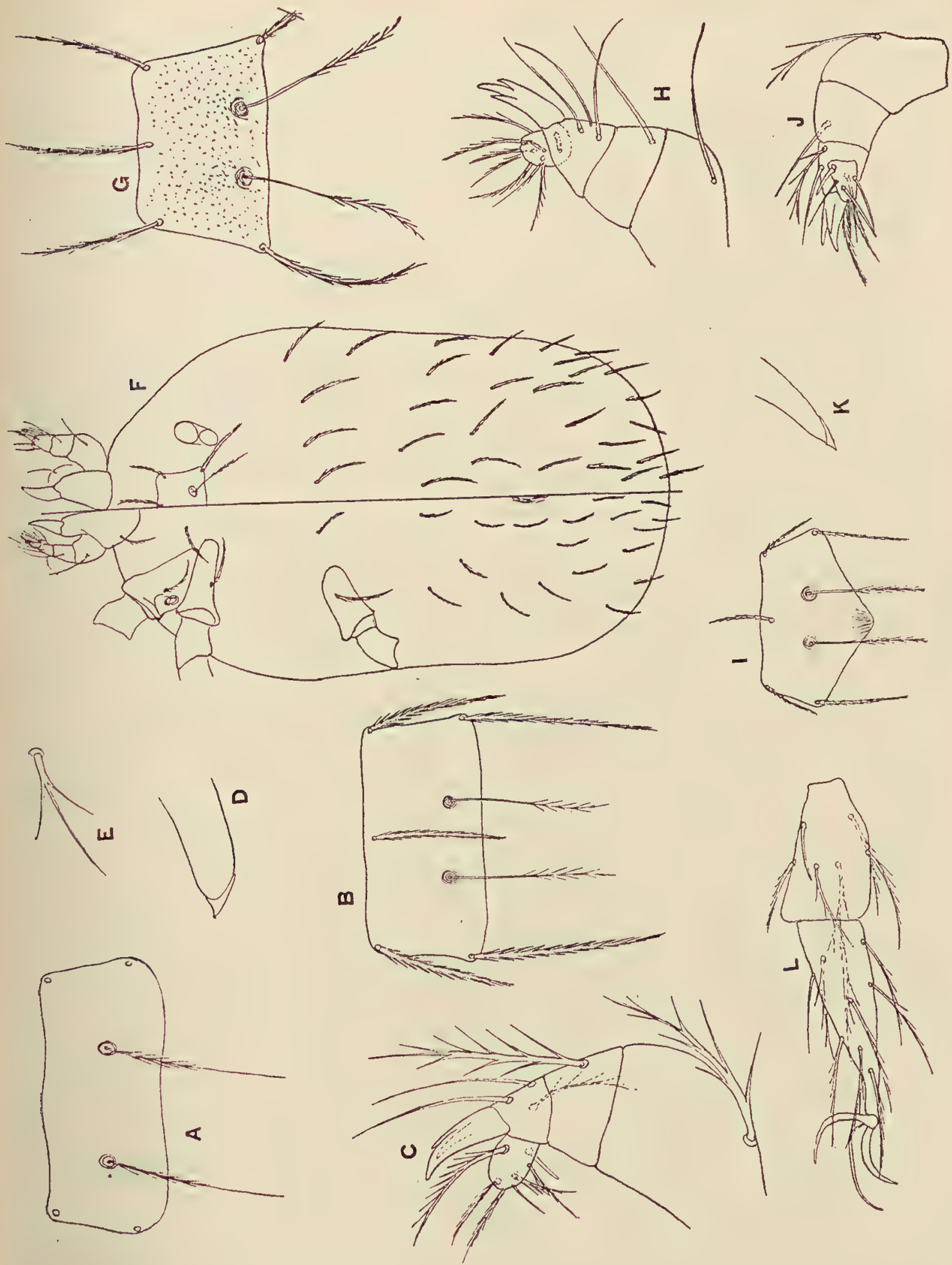

PLATE 23.

PLATE 24.

A–B. *Trombicula incurva* sp. n. A, scutum (× 500); B, palp.

C–F. *Trombicula leveri* sp. n. C, dorsal view; D ventral view; E, palp; F, scutum (× 500).

G. *Trombicula piercei* Ewing 1931. Scutum (× 500).

H–K. *Trombicula sylvestris* Audy and Traub, 1950. H, right dorsal and left ventral halves; I, scutum (× 500), with eyes; J, tip of chelicera; K, palp.

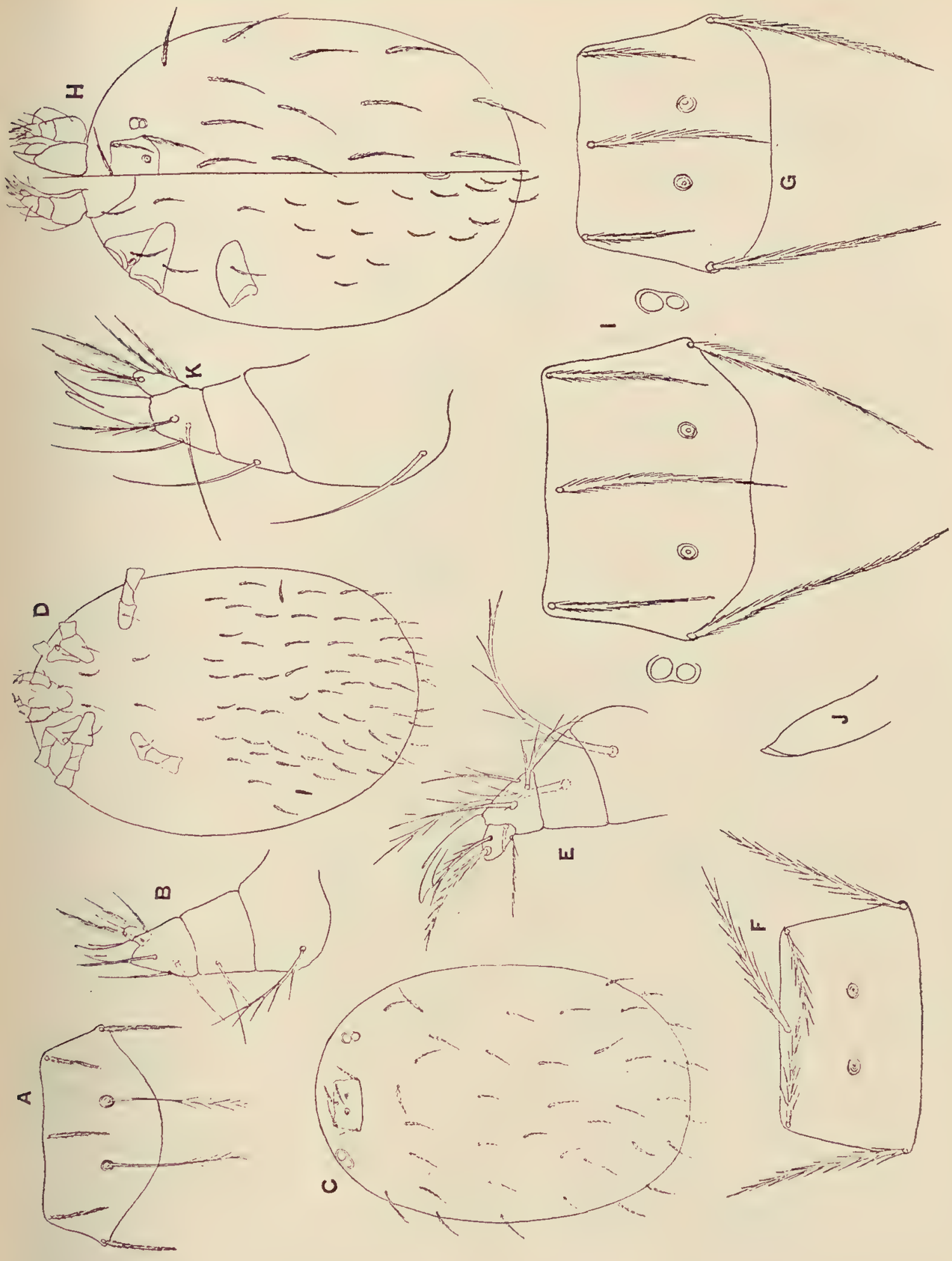

PLATE 24.

PLATE 25.

A–E. *Trombicula gliricolens* (Hirst 1915). A, dorsal view; B, ventral view; C, tip of chelicera and galeal seta; D, palp; E, scutum and eyes (× 500);

F–J. *Trombicula philipi* sp. n. F, scutum (× 500); G, palp; H, tip of chelicera; I, galeal seta; J, tarsus and metatarsus of leg III.

K–N. *Trombicula quadriense* Wom. and Heasp., 1943. K, scutum (× 500); L, palp; M, tip of chelicera; N, galeal seta.

PLATE 25.

PLATE 26.

A–E. *Trombicula pelta* sp. n. A, left half in dorsal view; B, right half in ventral view; C, scutum (× 500); D, tip of chelicera and galeal seta; E, palp.

F–J. *Trombicula jayewickremei* sp. n. F, dorsal view; G, ventral view; H, scutum (× 500); I, palp; J, tip of chelicera.

K–L. *Trombicula southcotti* sp. n. K, scutum (× 500); L, palp.

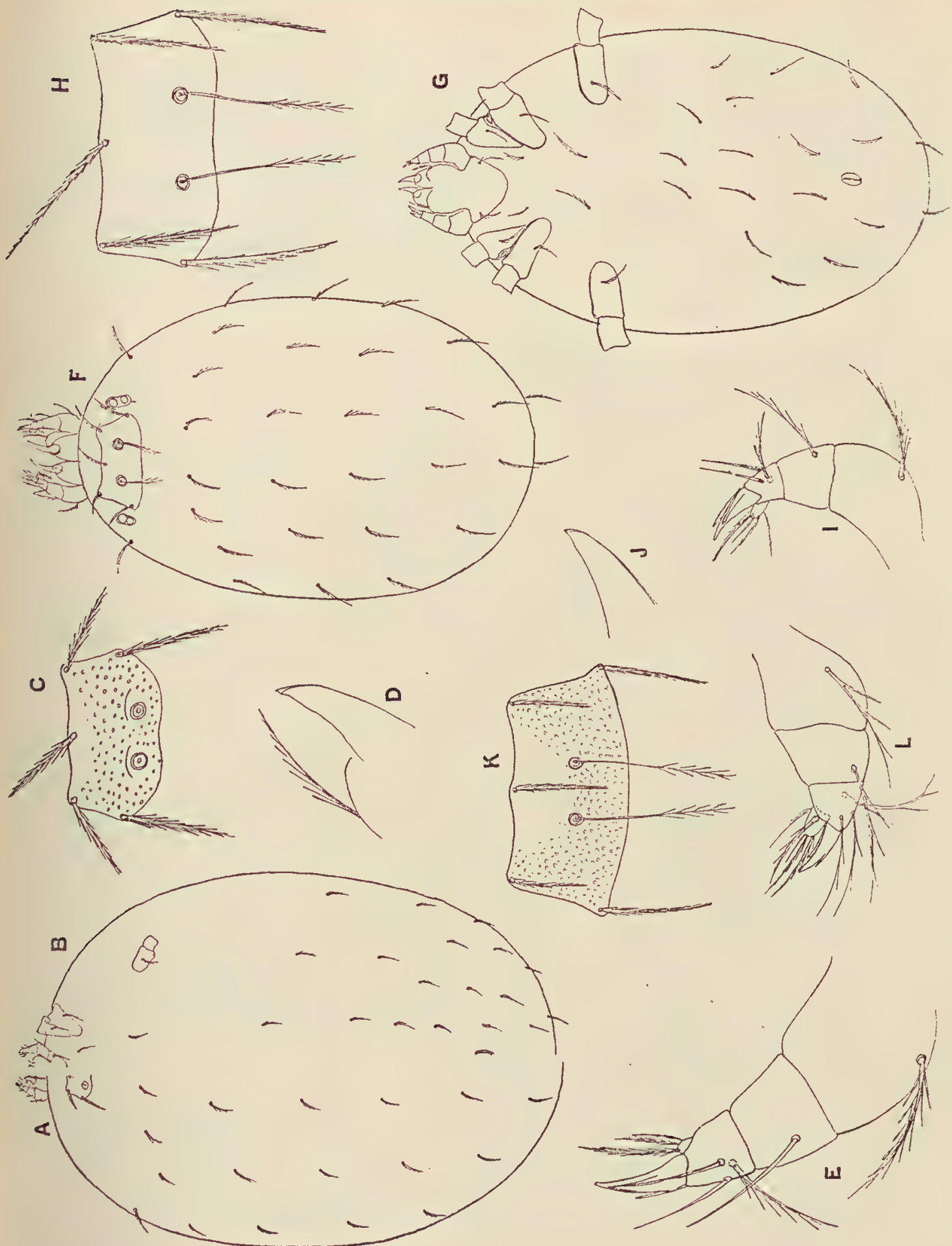

PLATE 26.

PLATE 27.

A–D. *Trombicula cuneata* (Traub and Evans 1951). A, right half of dorsum; B, left half of venter; C, scutum (× 500); D, palp.

E–I. *Trombicula squamifera* sp. n. E, dorsal view; F, ventral view; G, scutum (× 500); H, palp; I, tip of chelicera and galeal seta.

PLATE 27.

PLATE 28.

A–D. *Trombicula squamosa* (Radford, 1947). A, dorsal view; B, ventral view; C, scutum (× 500); D, palp.

E–I. *Trombicula foliacea* (Traub and Evans 1951). E, dorsal view; F, ventral view; G, scutum (× 500); H, palp; I, galeal seta.

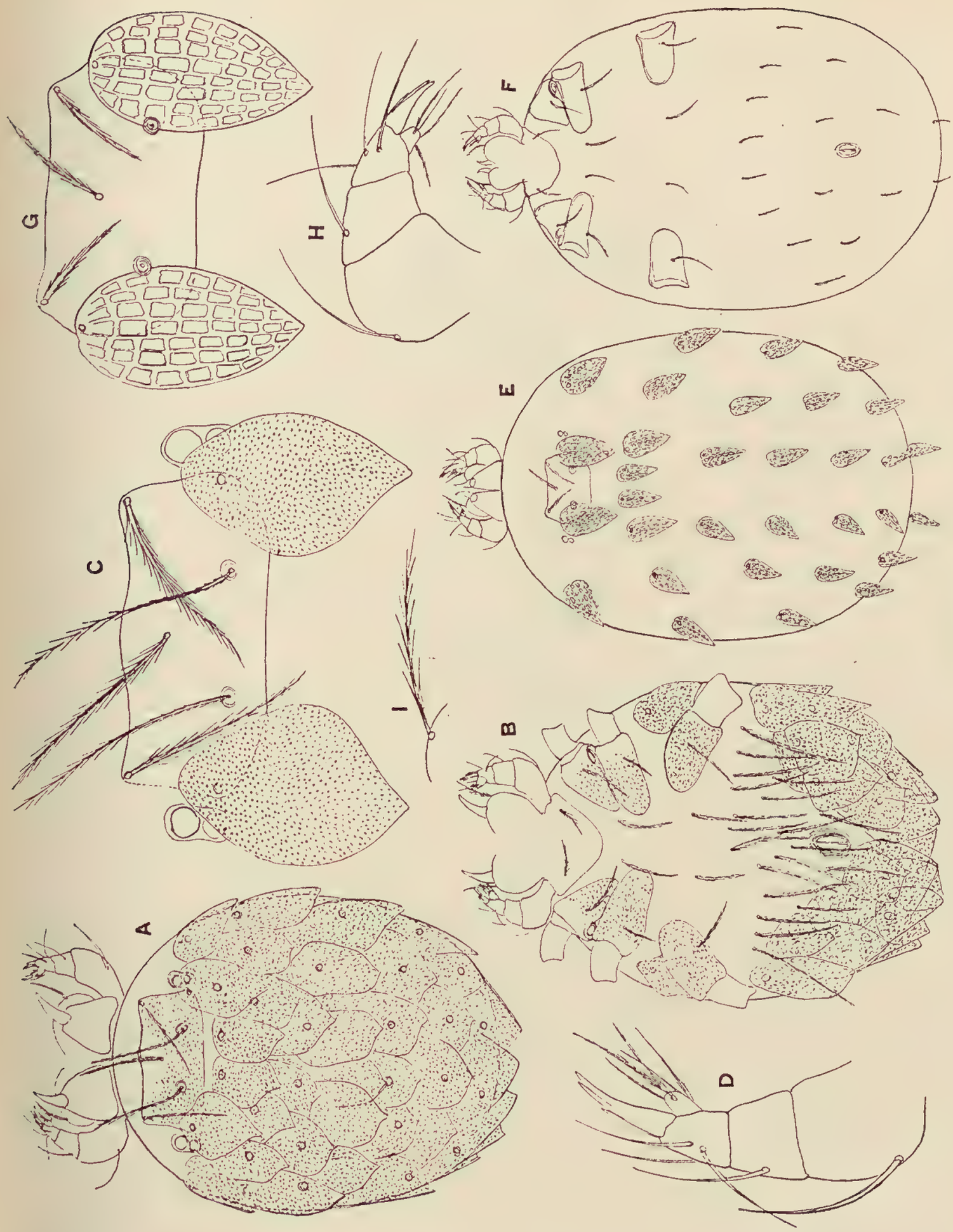

PLATE 28.

PLATE 29.

A–D. *Trombicula* (*Neotrombicula*) *harrisoni* sp. n. A, left half dorsum, right half venter; B, scutum (× 500); C, palp; D, mandible and galeal seta.

E–H. *Tecomatlana melvini* (Traub and Evans, 1950). E, left half dorsum, right half venter; F, scutum (× 500); G, palp; H, tip of chelicera (after Traub and Evans).

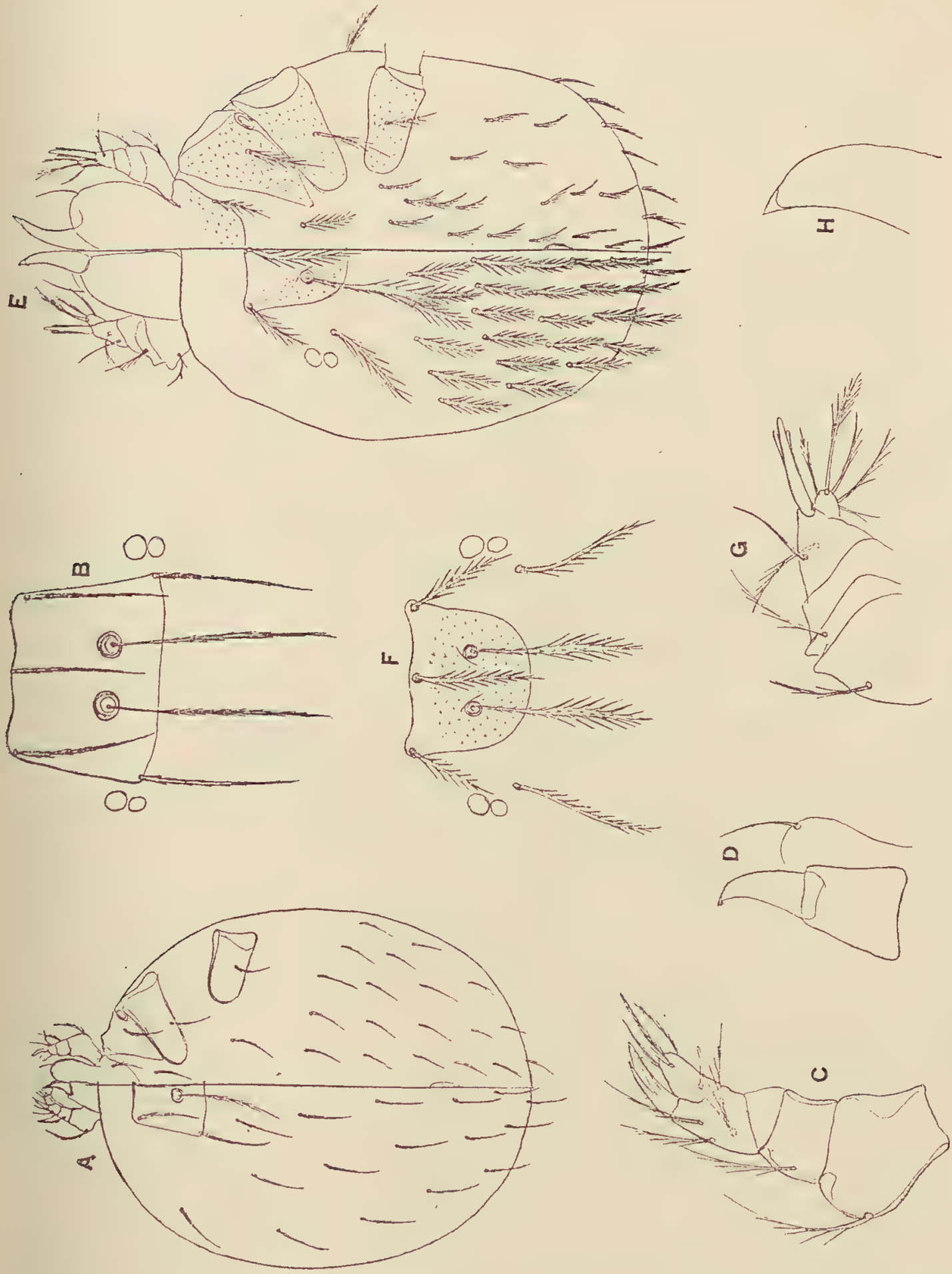

PLATE 29.

PLATE 30.

A–F. *Myotrombicula vespertilionis* Wom. and Heasp., 1943. A, scutum (× 500); B, palp; C, mandible; D, galeal seta; E, dorsal seta; F, tarsus and metatarsus of leg III.

G–L. *Heaslipia gateri* (Wom. and Heasp., 1943). G, scutum (× 500); H, tip of chelicera; I, palp; J, galeal seta; K, dorsal seta; L, tarsus and metatarsus of leg III.

PLATE 30.

PLATE 31.

A–H. *Novotrombicula owiensis* Wom. and Kohls, 1947. A, dorsal view; B, ventral view; C, scutum (× 500); D, palp; E, tip of chelicera; F, galeal seta; G, dorsal seta; H, tarsus and metatarsus of leg III.

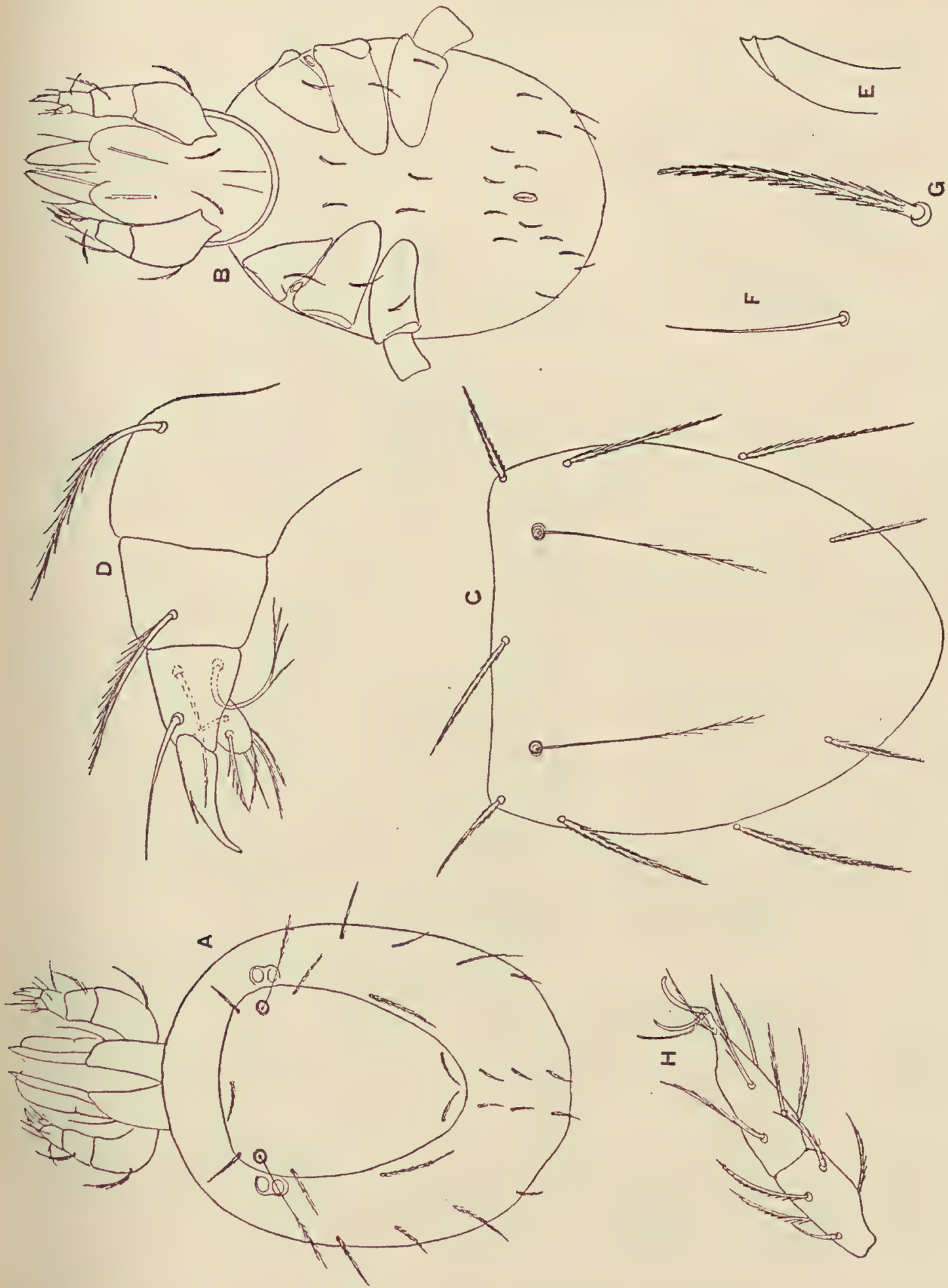

PLATE 31.

PLATE 32.

A–E. *Schöngastia* (*Schöngastia*) *oudemansi* (Walch, 1923). A, dorsal view; B, ventral view; C, chelicera and galeal seta; D, palp; E, scutum (× 500).

F–J *Schöngastia* (*Schöngastia*) *vandersandei* (Ouds., 1905). F, dorsal view; G, ventral view; H, scutum (× 500); I, tip of chelicera; J, palp.

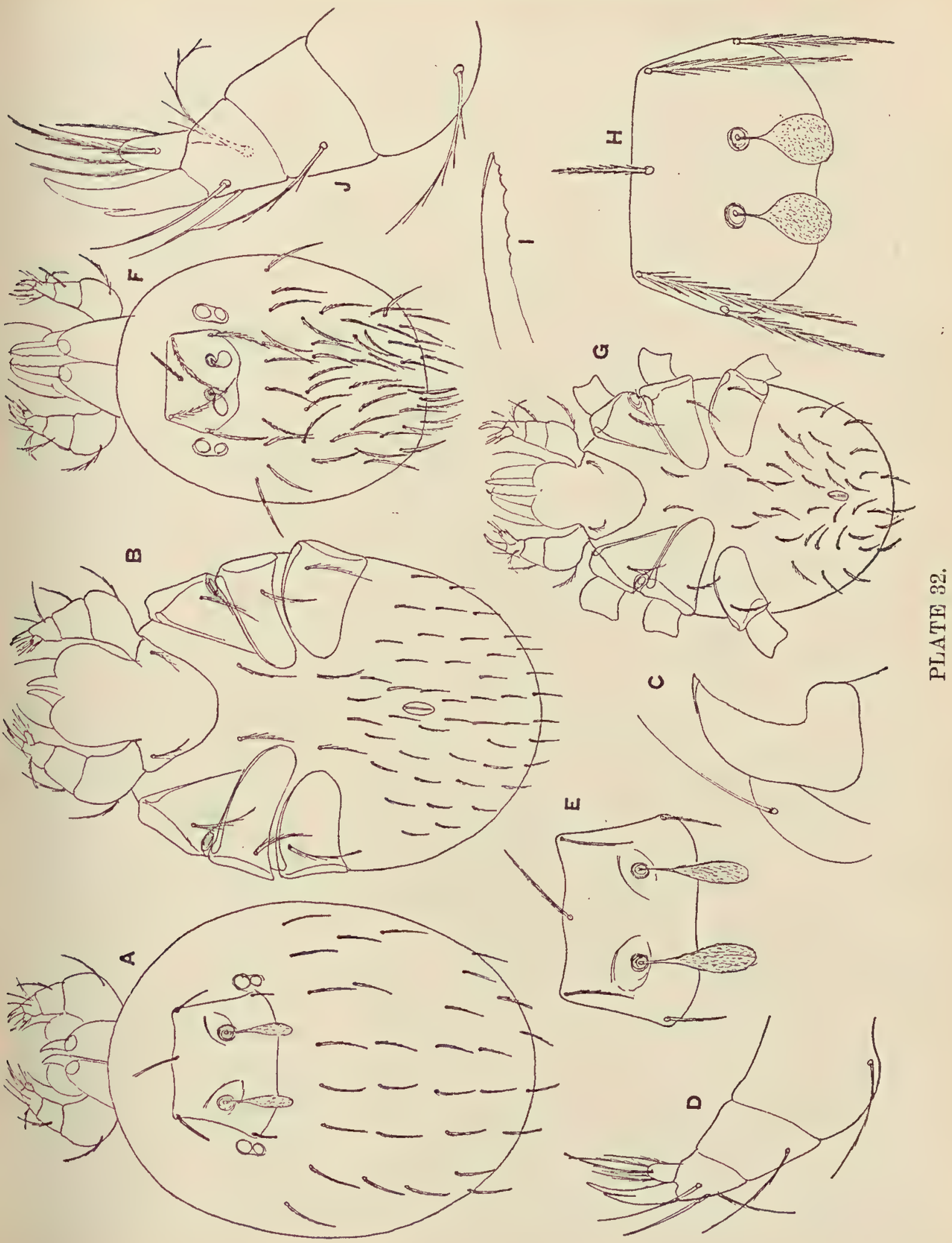

PLATE 32.

PLATE 33.

A–E. *Schöngastia* (*Schöngastia*) *schuffneri* (Walch, 1923). A, dorsal view; B, ventral view; C, tip of chelicera; D, palp; E, scutum (× 500).

F–J. *Schöngastia* (*Schöngastia*) *taylori* Gunther, 1940. F, dorsal view; G, ventral view; H, palp; I, tip of chelicera; J, scutum (× 500).

PLATE 33.

PLATE 34.

A–E. *Schöngastia* (*Schöngastia*) *whartoni* sp. n. A, dorsal view; B, ventral view; C, scutum (× 500); D, chelicera; E, palp.

F–J. *Schöngastia* (*Schöngastia*) *bidentata* sp. n. F, dorsal view; G, ventral view; H, scutum (× 500); I, palp; J, tip of chelicera.

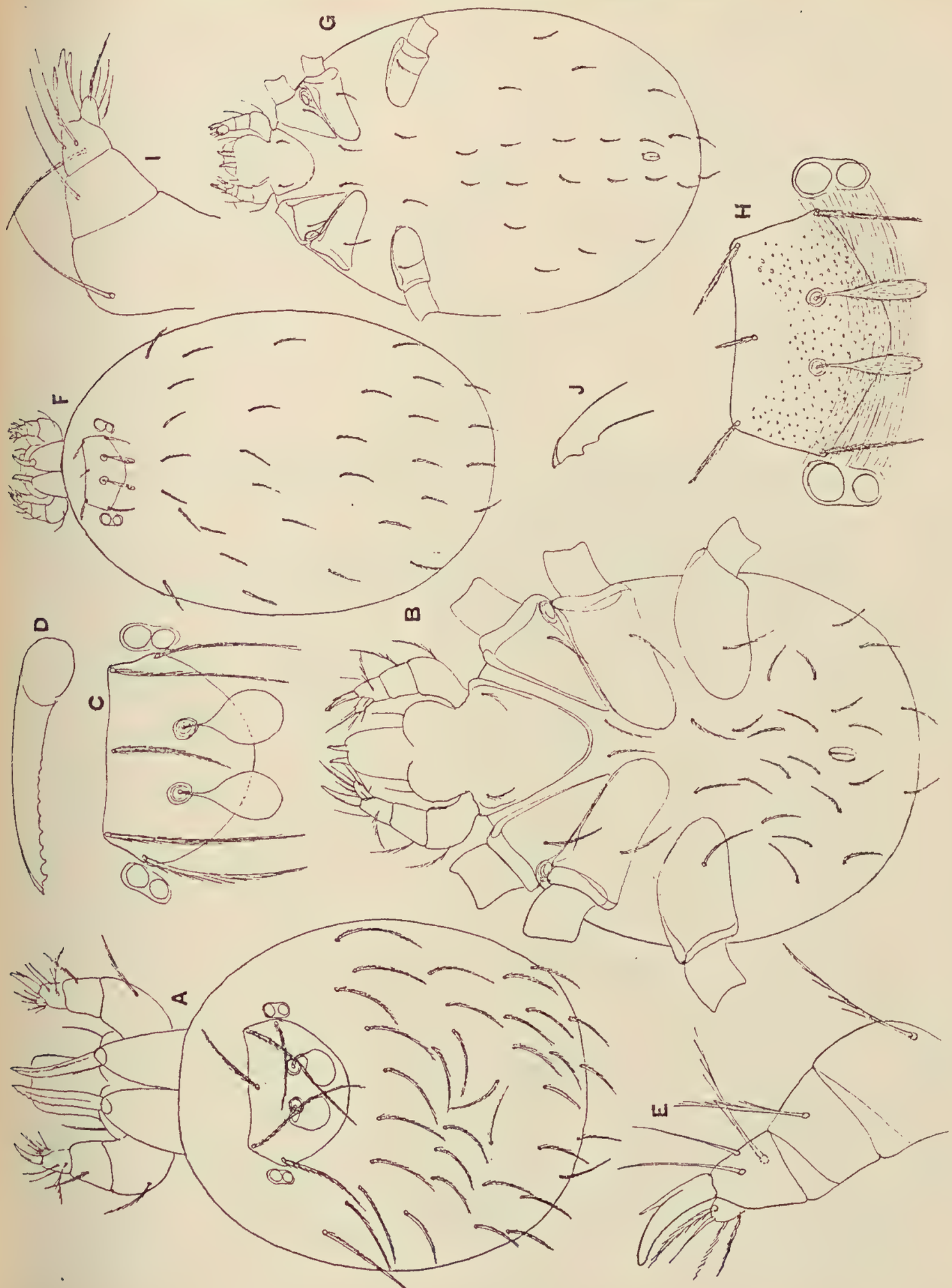

PLATE 34.

PLATE 35.

A–E. *Schöngastia* (*Schöngastia*) *victa* Gater, 1932. A, dorsal view; B, ventral view; C, scutum (× 500); D, palp; E, chelicera.

F–J. *Schöngastia* (*Schöngastia*) *philipi* Wom. and Kohls, 1947. F, dorsal view; G, ventral view; H, scutum (× 500); I, palp; J, chelicera.

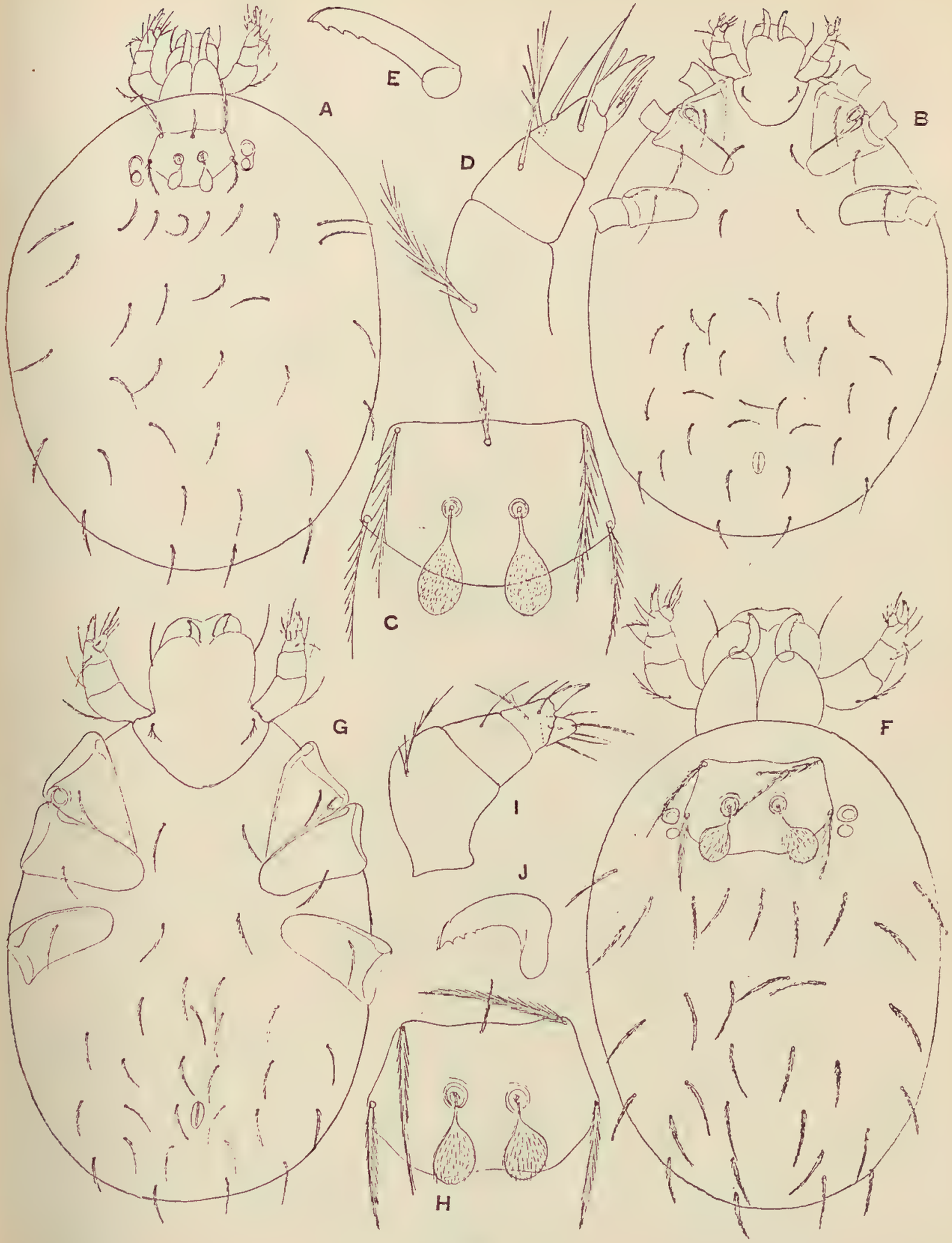

PLATE 35.

PLATE 36.

A–E. *Schöngastia* (*Schöngastia*) *blestowei* Gunther, 1939. A, dorsal view; B, ventral view; C, scutum (× 500); D, palp; E, tip of chelicera.

F–J. *Schöngastia* (*Schöngastia*) *blestowei* v. *megapodius* Wom. and Heasp., 1943. F, dorsal view; G, ventral view; H, scutum (× 500); I, palp; J, tip of chelicera.

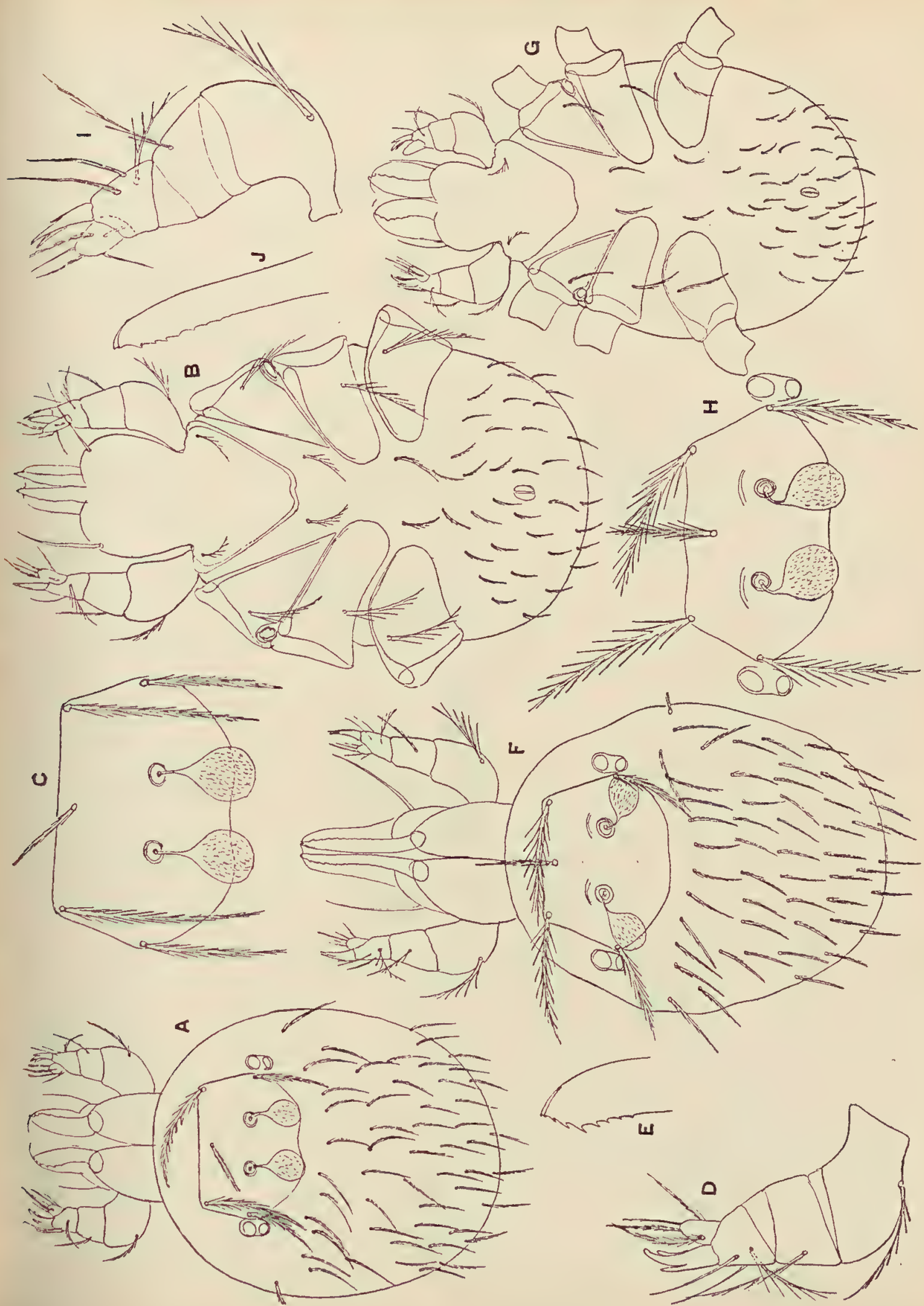

PLATE 36.

PLATE 37.

A–E. *Schöngastia* (*Schöngastia*) *oculicola* sp. n. A, dorsal view; B, venter; C, scutum (× 500); D, palp; E, chelicera.

F–J. *Schöngastia* (*Schöngastia*) *pseudoschuffneri* (Walch, 1927). F, dorsum; G, venter; H, scutum (× 500); I, palp; J, mandible.

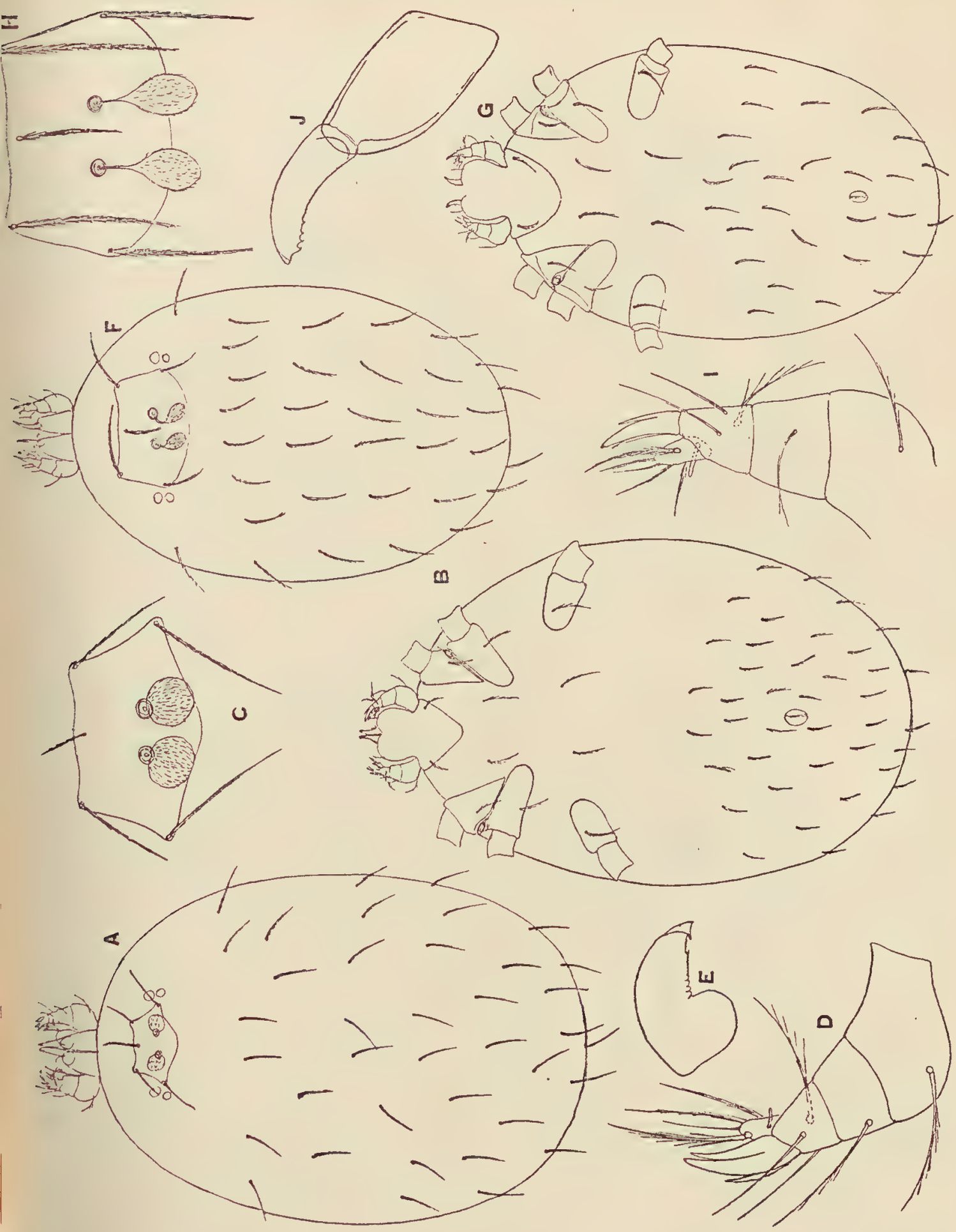

PLATE 37.

PLATE 38.

A–E. *Schöngastia* (*Schöngastia*) *maldiviensis* Radford, 1946. A, dorsum; B, venter; C, scutum (× 500); D, palp; E, chelicera.

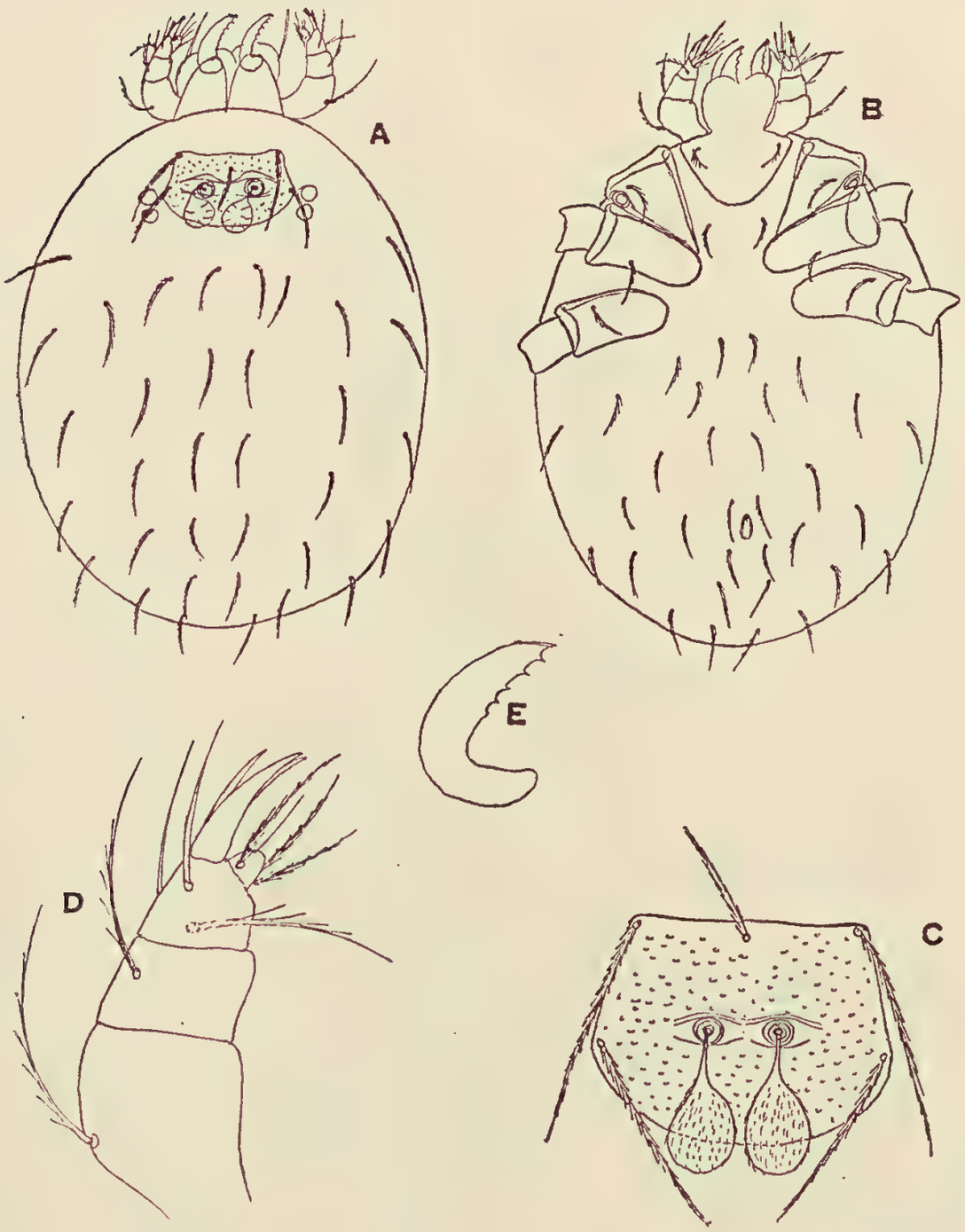

PLATE 38.

PLATE 39.

A–E. *Schöngastia* (*Ascoschöngastia*) *pseudomys* sp. n. A, dorsum; B, venter; C, scutum (× 500); D, palp; E, tip of chelicera and galeal seta.

F–K. *Schöngastia* (*Ascoschöngastia*) *mccullochi* (Wom., 1944). F, dorsum; G, venter; H, scutum (× 500); I, palp; J, tip of chelicera and galeal seta; K, dorsal setae much enlarged.

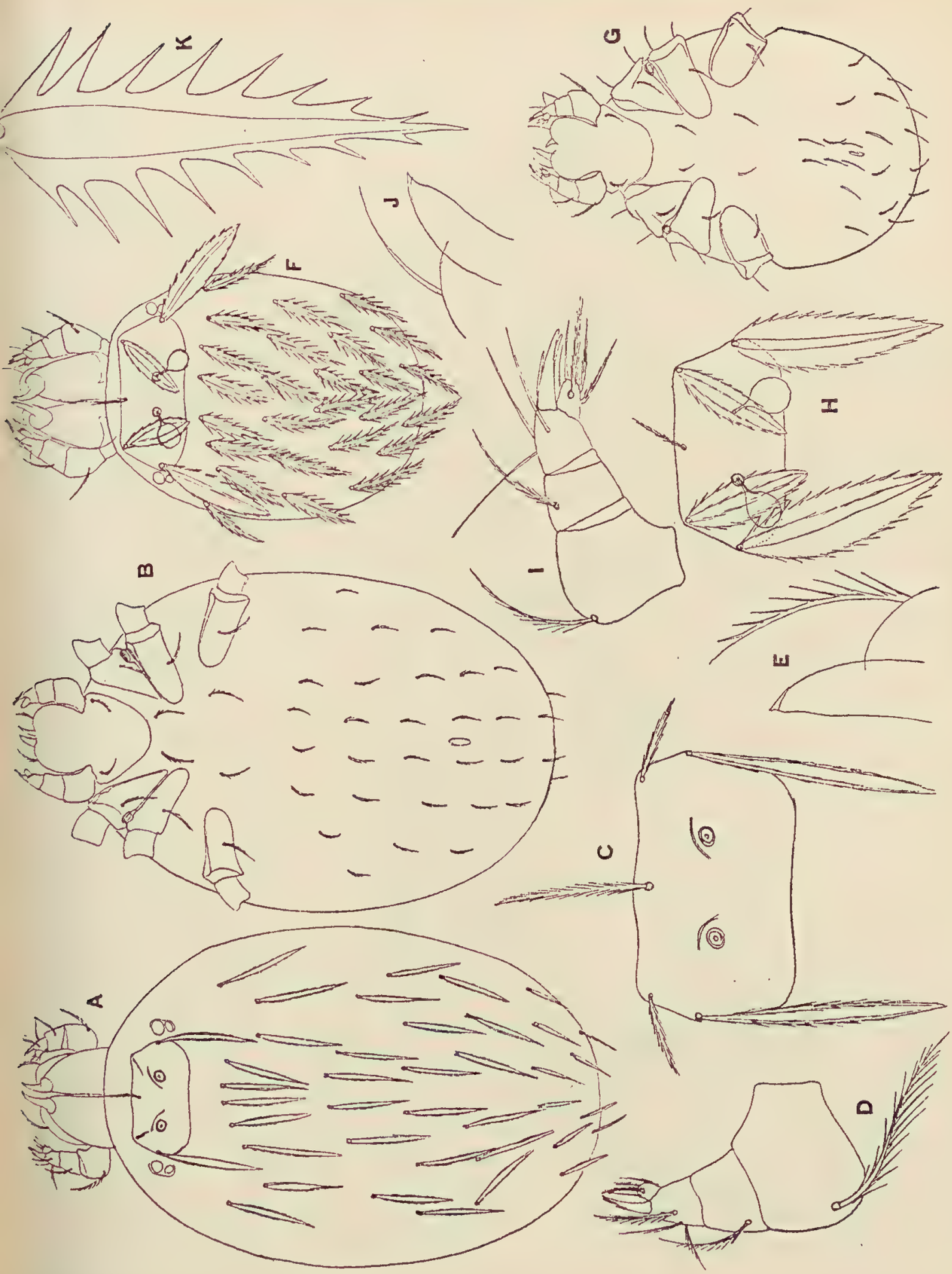

PLATE 39.

PLATE 40.

A–F. *Schöngastia* (*Ascoschöngastia*) *uromys* (Wom. and Kohls., 1947). A, dorsum; B, venter; C, tip of chelicera; D, scutum (× 500); E, palp; F, dorsal and ventral setae.

G–I. *Schöngastia* (*Ascoschöngastia*) *foliata* (Gunther, 1940). G, dorsum; H, venter; I, scutum (× 500).

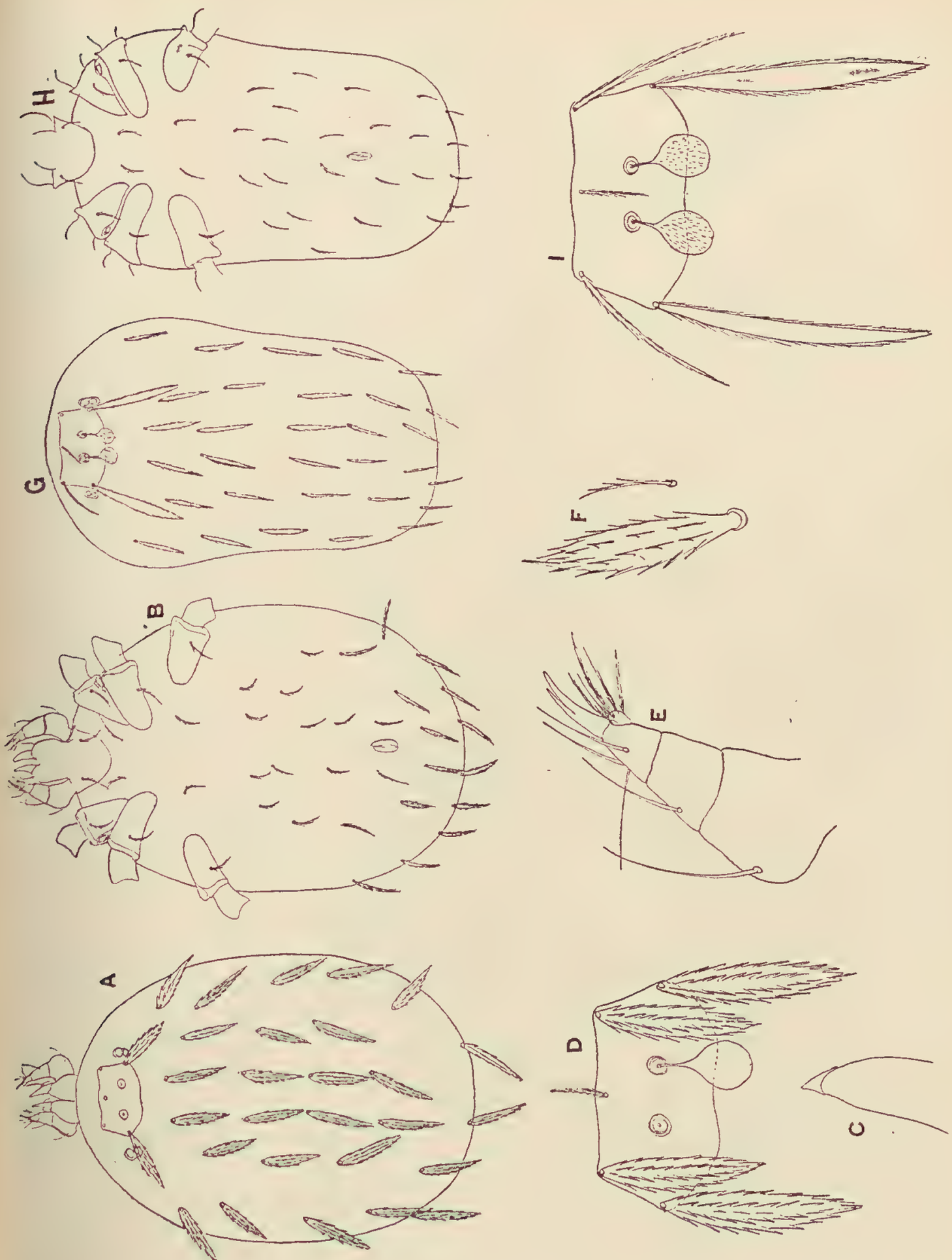

PLATE 40.

PLATE 41.

A–D. *Schöngastia* (*Ascoschöngastia*) *signata* sp. n. A, dorsum; B, venter; C, scutum (× 500); D, palp.

E–F. *Schöngastia* (*Ascoschöngastia*) *? globularc* (Walch, 1927). E, dorsum; F, scutum (× 500).

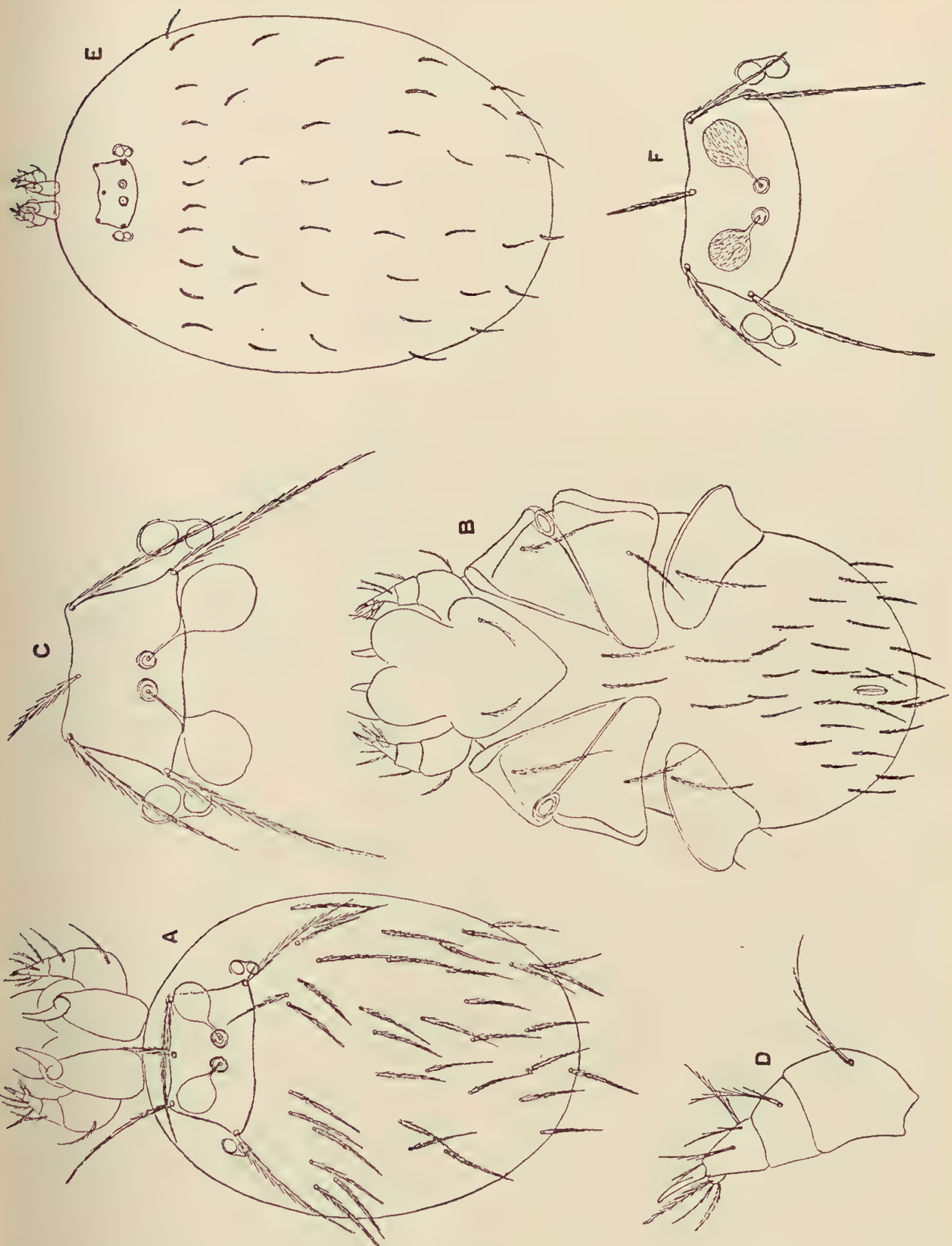

PLATE 41.

PLATE 42.

A–B. *Schöngastia* (*Ascoschöngastia*) *? globulare* (Walch, 1927). A, venter; B, palp.

C–F. *Schöngastia* (*Ascoschöngastia*) *kohlsi* (Philip and Woodward, 1946). C, dorsum; D, venter; E, scutum (× 500); F, palp.

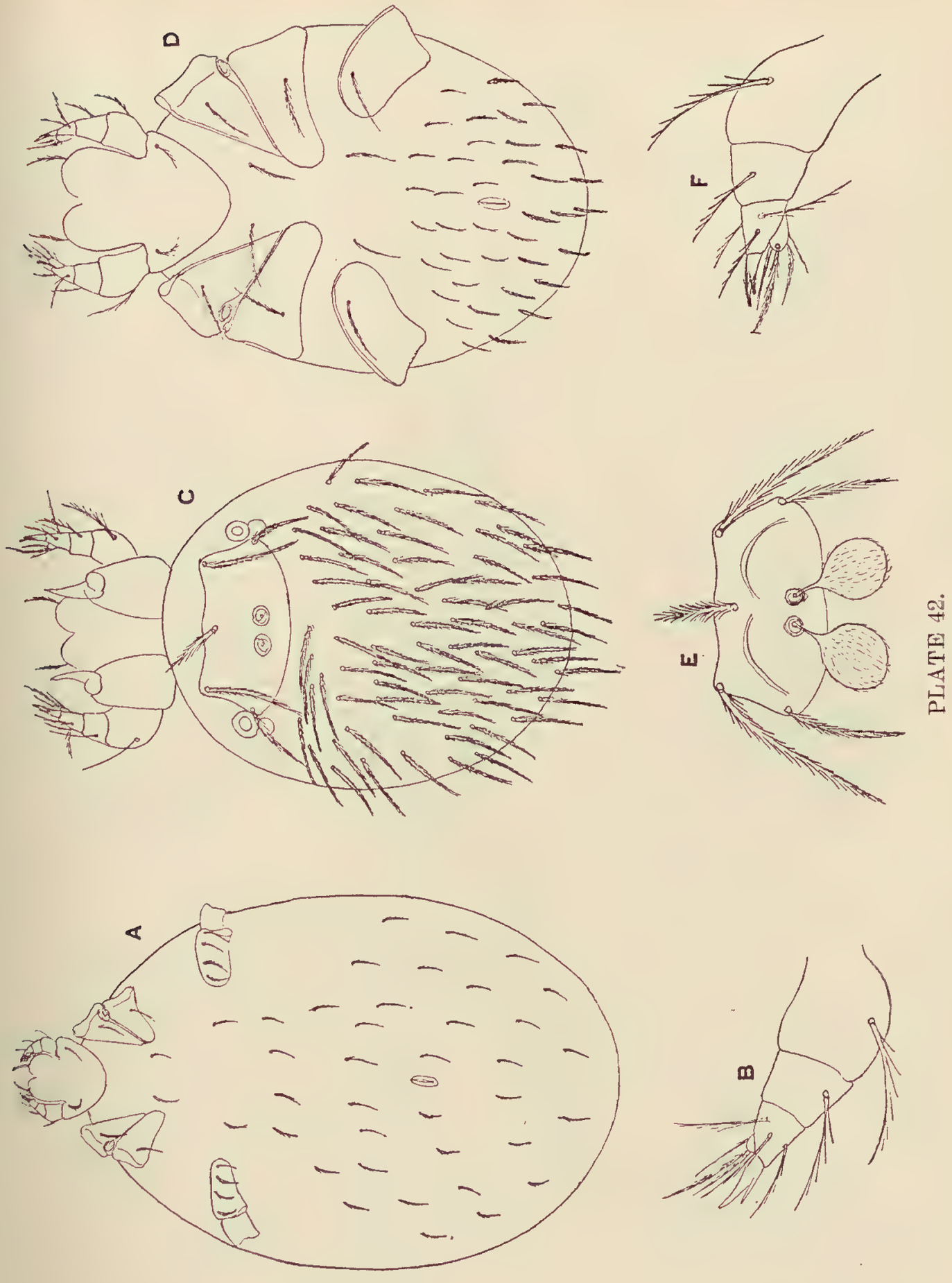

PLATE 42.

PLATE 43.

A–E. *Schöngastia* (*Ascoschöngastia*) *comata* sp. n. A, dorsum; B, venter; C, chelicera and galeal setæ; D, palp; E, scutum (× 500).

F–H. *Schöngastia* (*Ascoschöngastia*) *lanius* (Radford, 1946). F, dorsum; G, scutum (× 500); H, palp.

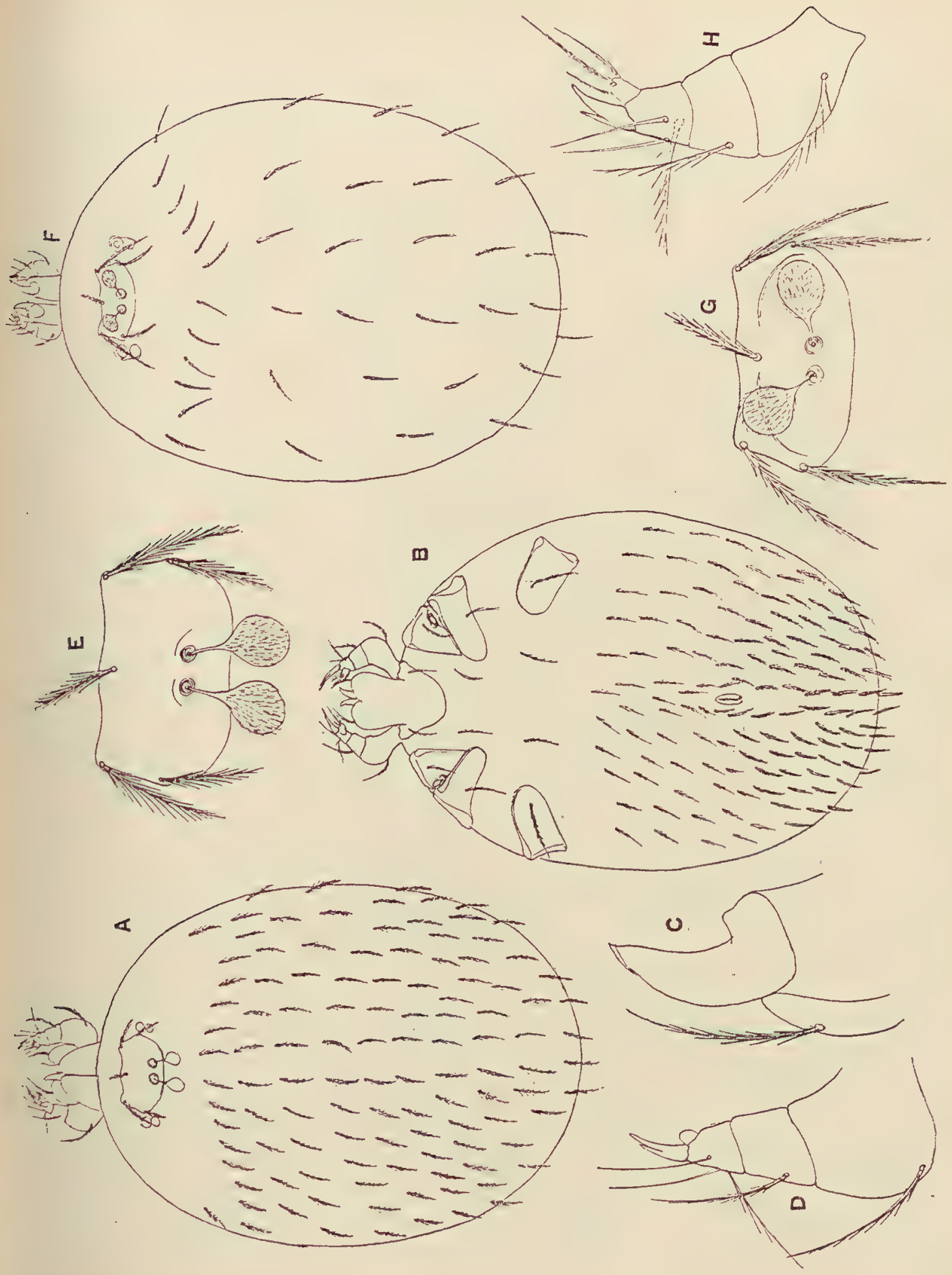

PLATE 43.

PLATE 44.

A. *Schöngastia* (*Ascoschöngastia*) *lanius* (Radford, 1946). Venter.

B–E. *Schöngastia* (*Ascoschöngastia*) *mutabalis* (Gater, 1932). B, dorsum; C, venter; D, palp; E, scutum (× 500).

F–H. *Schöngastia* (*Ascoschöngastia*) *edwardsi* (Guntheri, 1939). F, dorsum; G, venter; H, scutum (× 500).

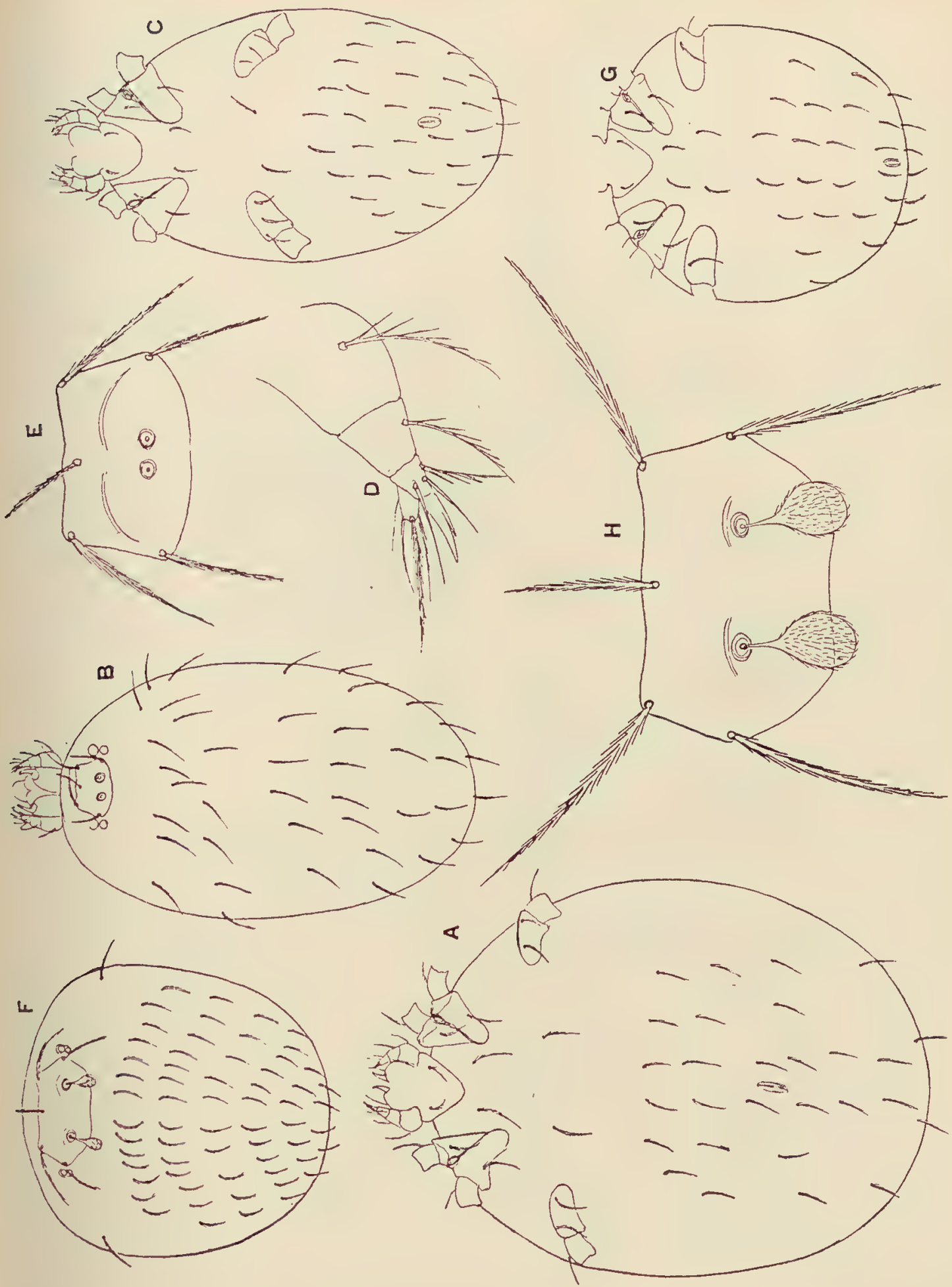

PLATE 44.

PLATE 45.

A–C. *Schöngastia* (*Ascoschöngastia*) *philippensis* (Philip and Woodward, 1946). A, scutum (× 500); B, palp; C, tip of chelicera.

D–I. *Schöngastia* (*Ascoschöngastia*) *mackerrasae* sp. n. D, dorsum; E, venter; F, scutum (× 500); G, palp; H, tip of chelicera; I, dorsal seta.

J–M. *Schöngastia* (*Ascoschöngastia*) *petrogale* (Wom., 1934). J, scutum (× 500); K, coxa III; L, tip of chelicera; M, palp.

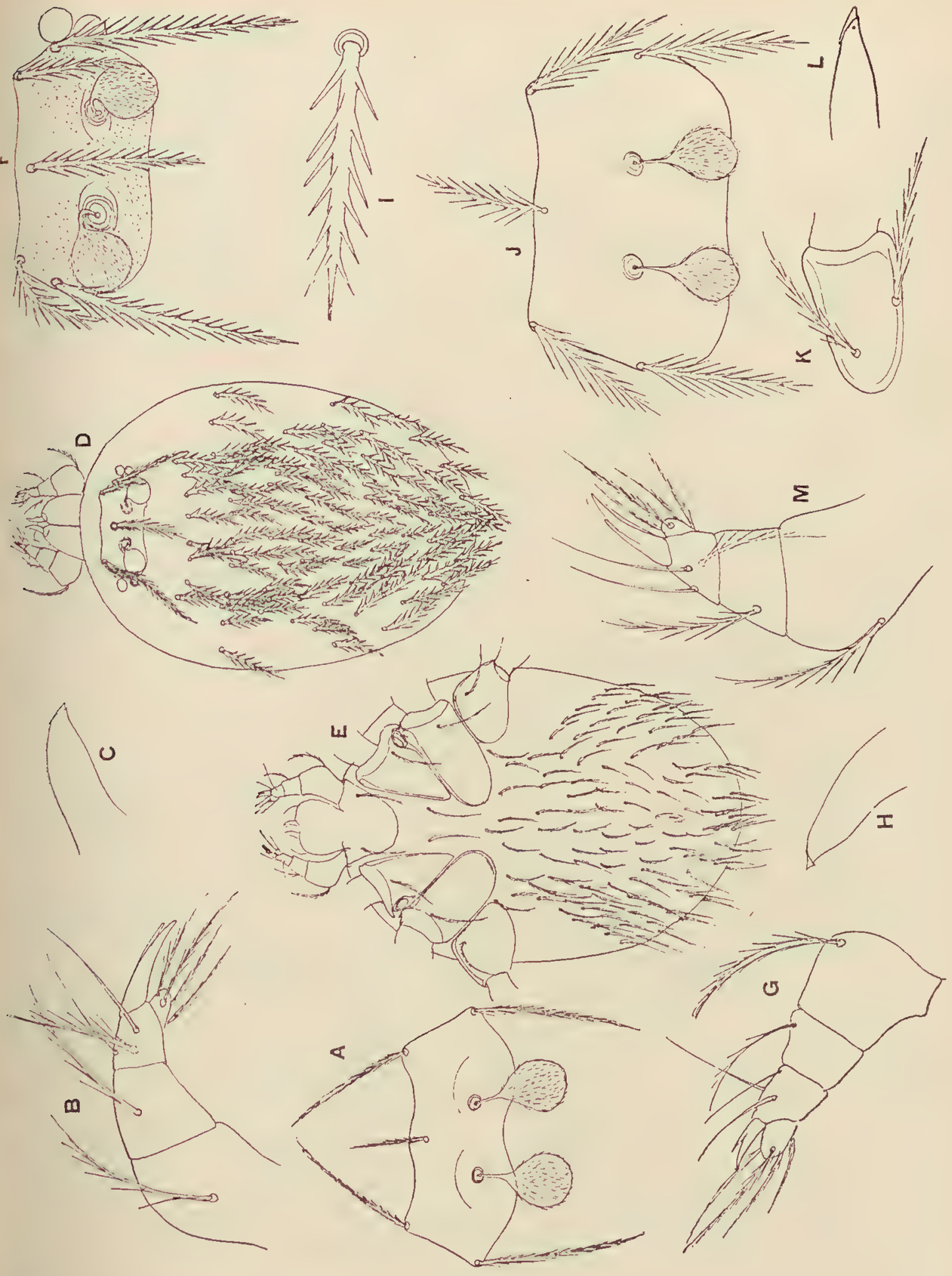

PLATE 45.

PLATE 46.

A–C. *Schöngastia* (*Ascoschöngastia*) *mohri* sp. n. A, scutum (× 500); B, palp; C, tip of chelicera.

D–G. *Schöngastia* (*Ascoschöngastia*) *crinita* sp. n. D, scutum (× 500); E, palp; F, tip of chelicera; G, crenulate dorsal striations.

H–L. *Schöngastia* (*Ascoschöngastia*) *rectangulare* sp. n. H, dorsum; I, venter; J, scutum (× 500); K, tip of chelicera; L, palp.

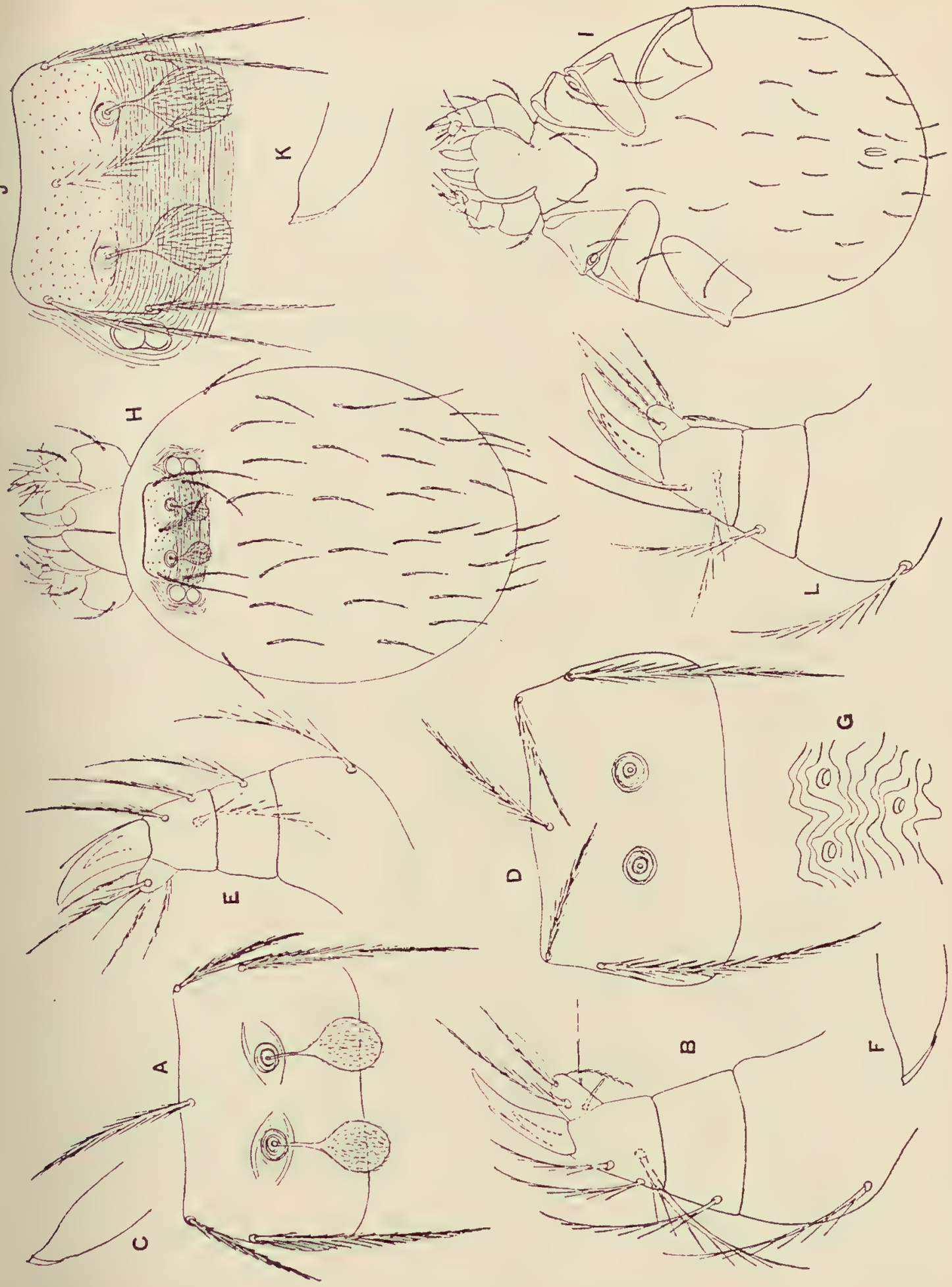

PLATE 46.

PLATE 47.

A–D. *Schöngastia* (*Ascoschöngastia*) *antipodianum* (Hirst, 1929). A, dorsum; B, venter; C, scutum (× 500); D, palp.

E–F. *Schöngastia* (*Ascoschöngastia*) *cassiope* sp. n. E, dorsum; F, palp.

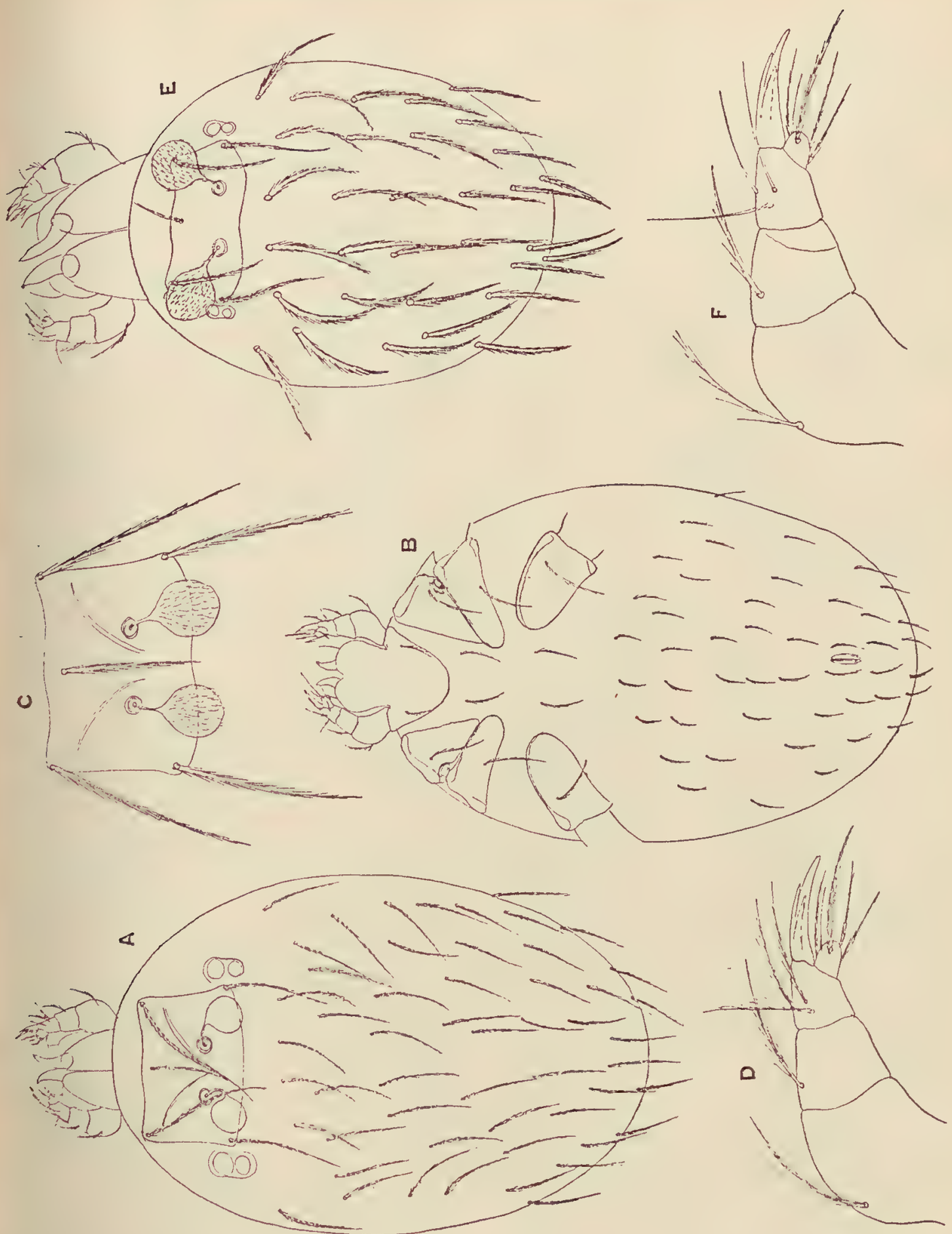

PLATE 47.

PLATE 48.

A–B. *Schöngastia* (*Ascoschöngastia*) *cassiope* sp. n. A, venter; B, scutum (× 500).

C–F. *Schöngastia* (*Ascoschöngastia*) *dumosa* sp. n. C, scutum (× 500); D, dorsal setae and striations; E, palp; F, tip of chelicera.

G–K. *Schöngastia* (*Ascoschöngastia*) *queenslandica* (Wom., 1939). G, dorsum; H, venter; I, scutum (× 500); J, tip of chelicera; K, palp.

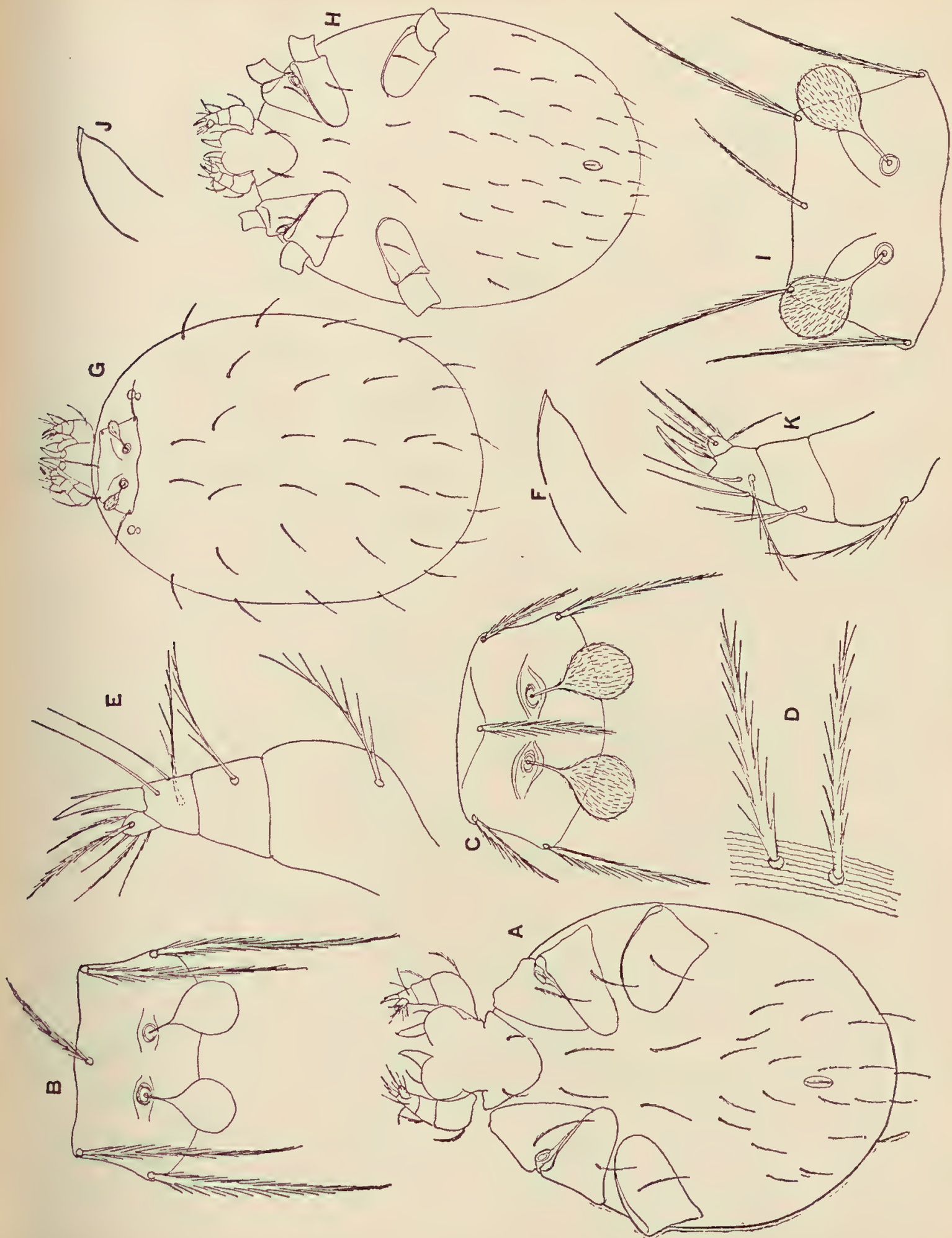

PLATE 48.

PLATE 49.

A–D. *Schöngastia* (*Ascoschöngastia*) *lappacea* n. comb. A, dorsum; B, venter; C, scutum (× 500); D, palp.

E–G. *Schöngastia* (*Ascoschöngastia*) *womersleyi* (Gunther, 1939). E, dorsum; F, scutum (× 500); G, palp.

PLATE 49.

PLATE 50.

A. *Schöngastia* (*Ascoschöngastia*) *womersleyi* (Gunther, 1939). Venter.

B–E. *Schöngastia* (*Ascoschöngastia*) *coorongense* (Hirst, 1929). B, dorsum; C, venter; D, palp; E, scutum (× 500).

F–I. *Schöngastia* (*Ascoschöngastia*) *echymipera* (Wom. and Kohls, 1947). F, dorsum; G, scutum (× 500); H, tip of chelicera; I, palp.

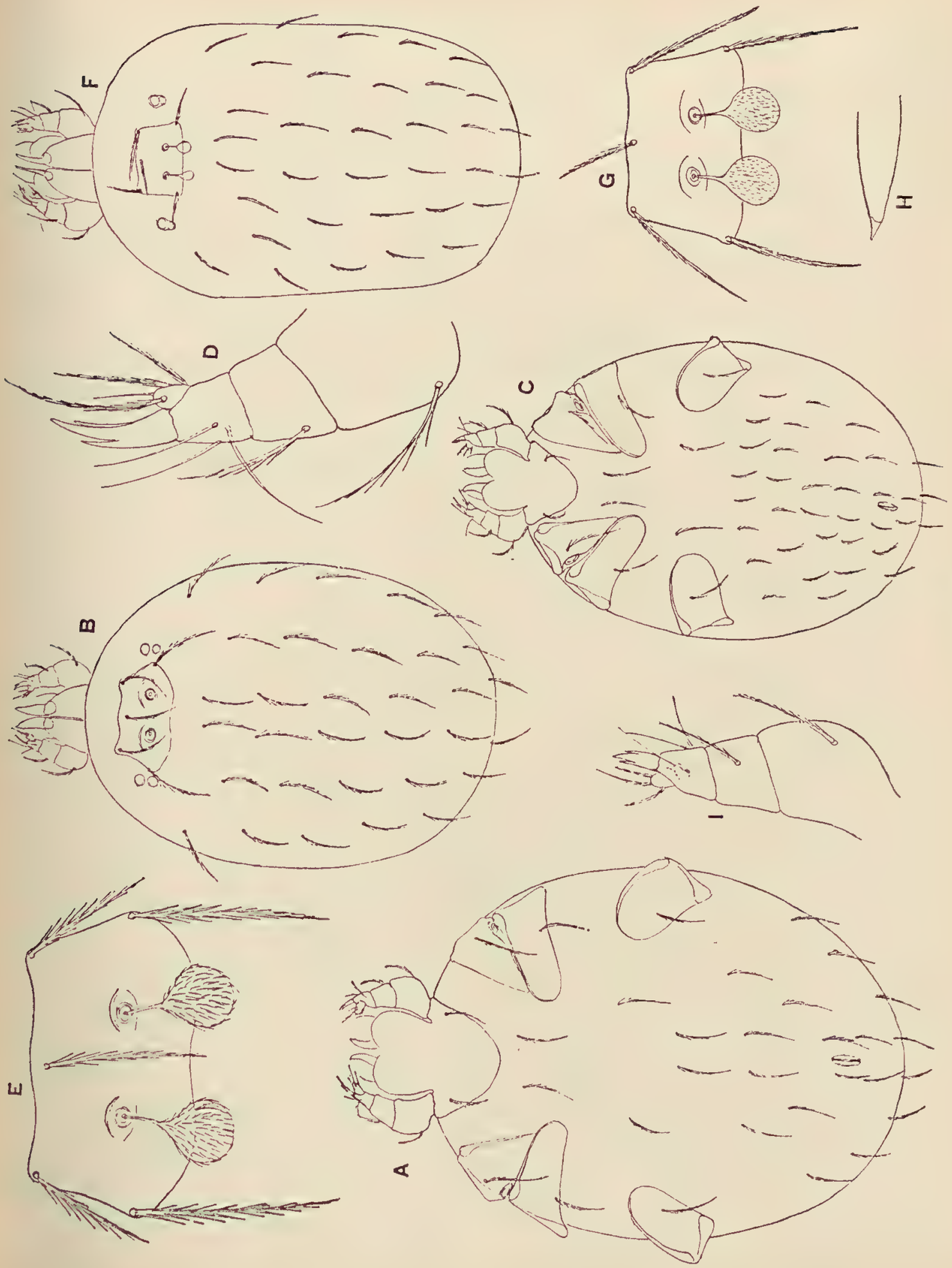

PLATE 50.

PLATE 51.

A. *Schöngastia* (*Ascoschöngastia*) *cchymipera* (Wom. and Kohls, 1947). Venter.

B–E. *Schöngastia* (*Ascoschöngastia*) *innisfailensis* (Wom. and Heasp., 1943). B, dorsum; C, venter; D, scutum (× 500); E, palp.

F–I. *Schöngastia* (*Ascoschöngastia*) *lacunosa* (Gater, 1932). F, dorsum; G, scutum (× 500); H, palp; I, tip of chelicera.

J–K. *Schöngastia* (*Ascoschöngastia*) *malayensis* (Gater, 1932). J, dorsum; K, scutum (× 500).

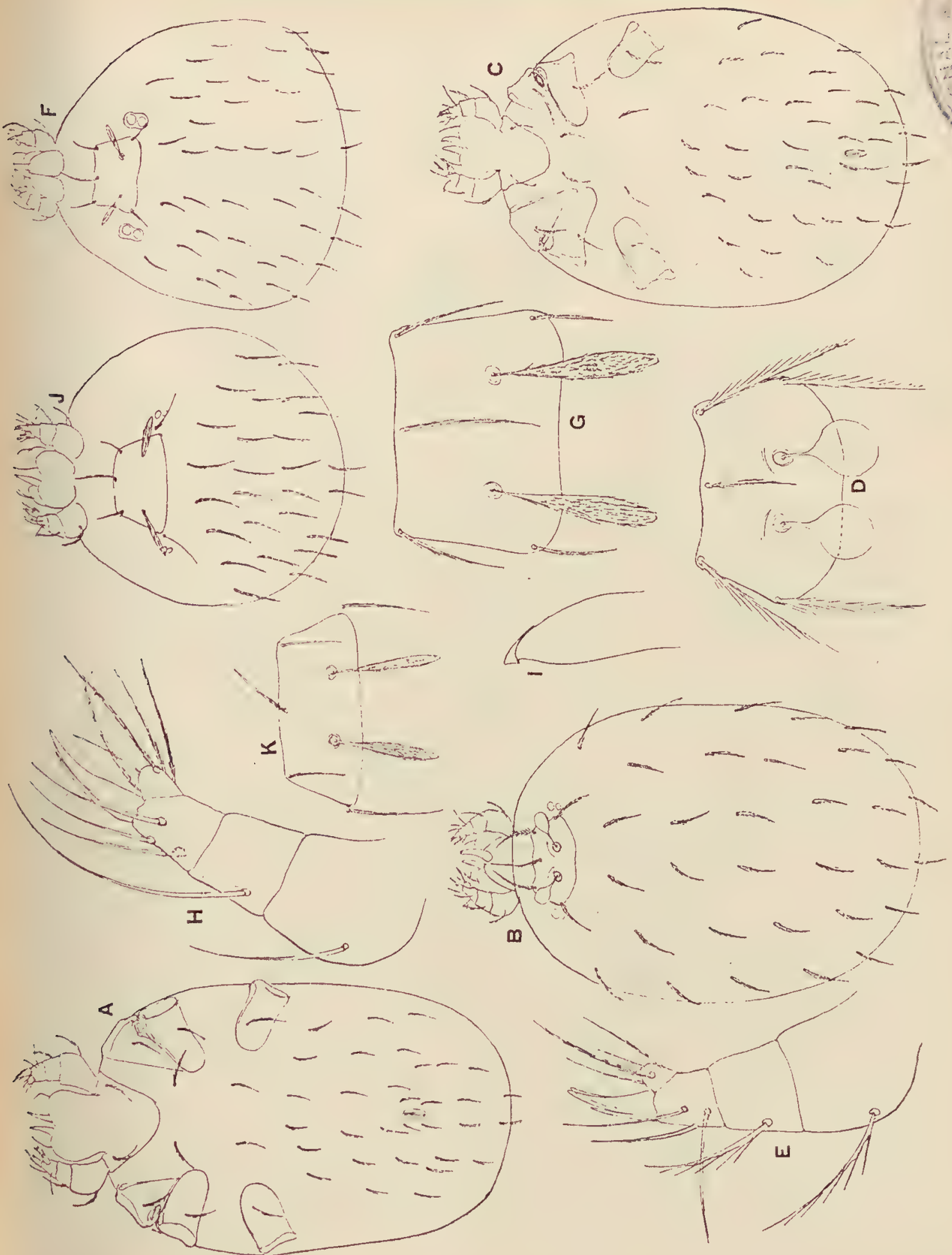

PLATE 51.

PLATE 52.

A–E. *Schöngastia* (*Ascoschöngastia*) *nausheraensis* sp. n. A, dorsum; B, venter; C, scutum (× 500); D, palp; E, coxa III.

F–H. *Schöngastia* (*Ascoschöngastia*) *lipoxena* sp. n. F, scutum (× 500); G, mandible; H, palp.

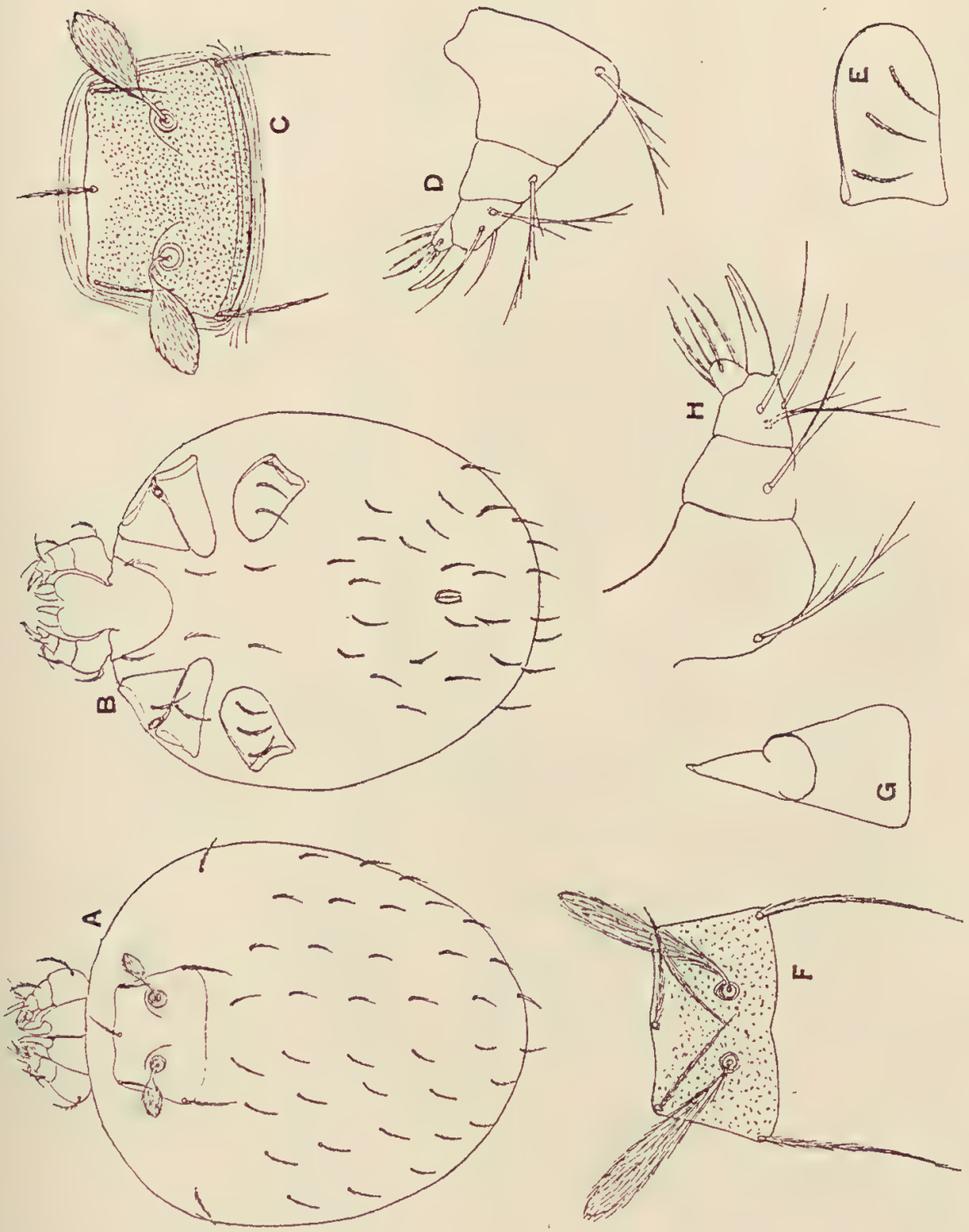

PLATE 52.

PLATE 53.

A. *Schöngastia* (*Ascoschöngastia*) *debilis* (Gater, 1932). Scutum (× 500); (after Gater).

B–D. *Schöngastia* (*Ascoschöngastia*) *manipurensis* (Radford, 1946). B, dorsum; C, venter; D, scutum (× 500).

E–J. *Schöngastia* (*Ascoschöngastia*) *labuanensis* sp. n. E, dorsum; F, venter; G, scutum (× 500); H, palp; I, tip of chelicera; J, tarsus and metatarsus of leg I.

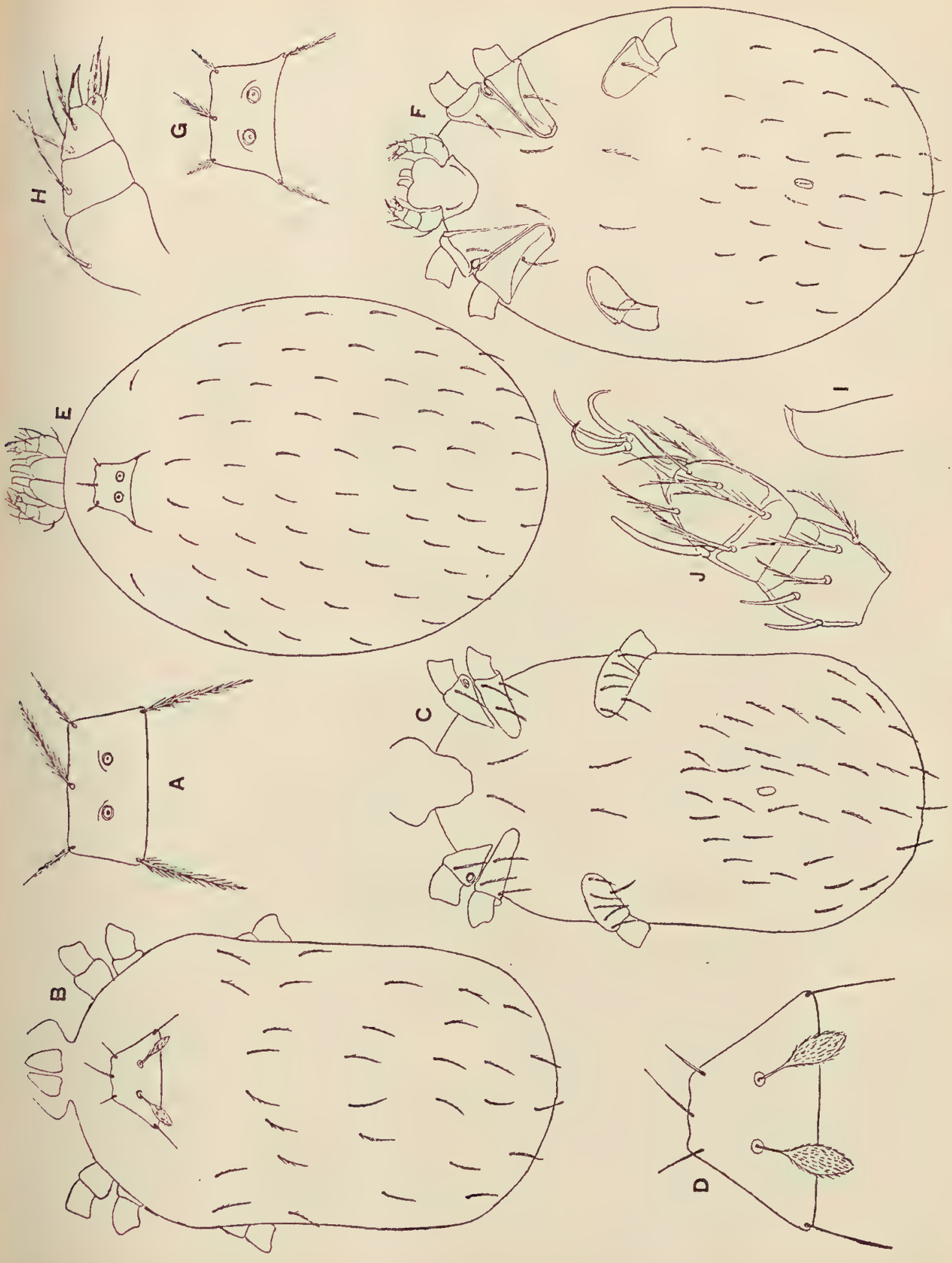

PLATE 53.

PLATE 54.

A–E. *Schöngastia* (*Ascoschöngastia*) *audyi* sp. n. A, dorsum; B, venter; C, scutum (× 500); D, chelicera and galeal seta; E, palp.

F–I. *Schöngastia* (*Ascoschöngastia*) *rattus* (Wom. and Heasp., 1943). F, dorsum; G, scutum (× 500); H, tip of chelicera and galeal seta; I, palp.

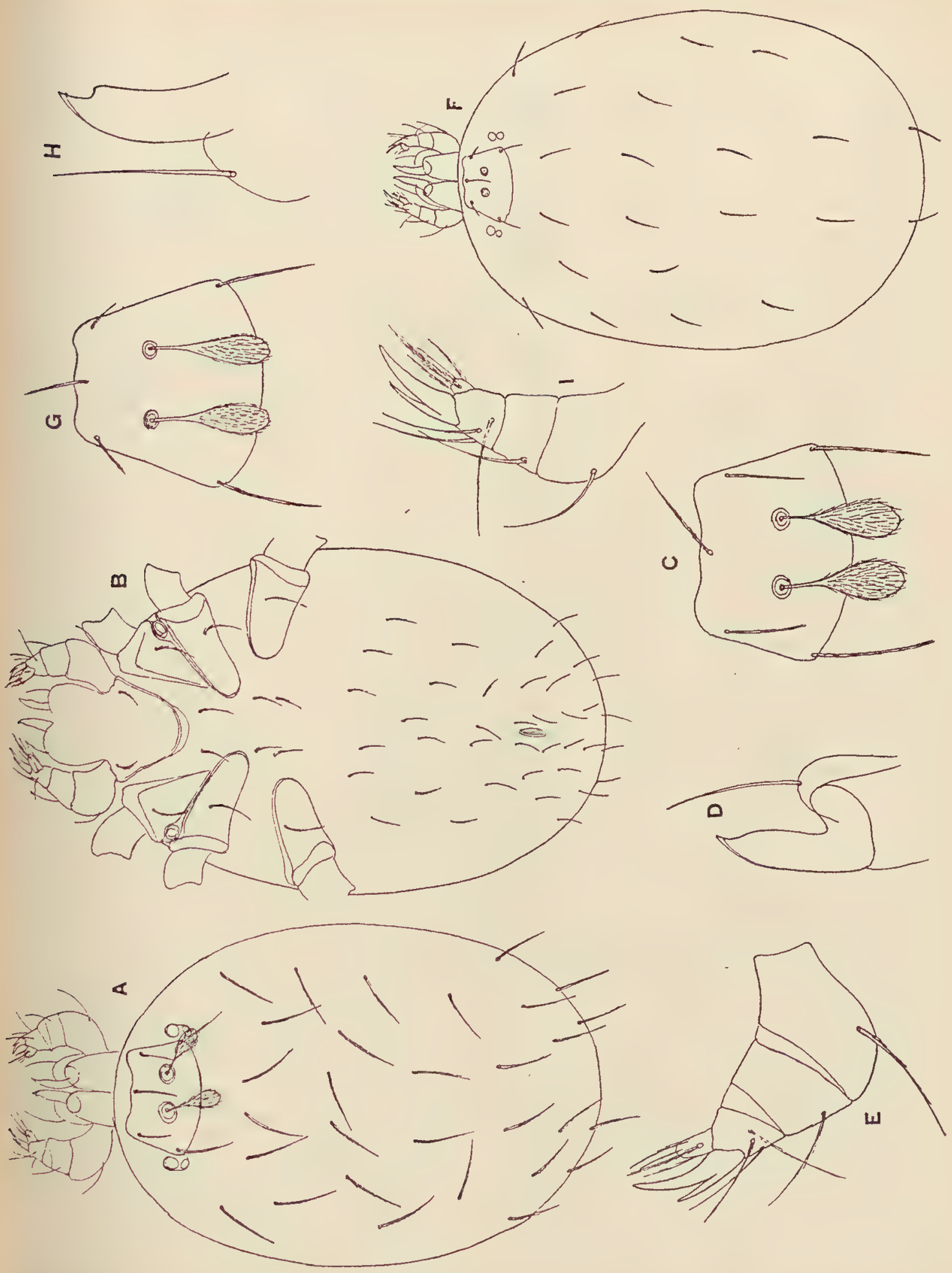

PLATE 54.

PLATE 55.

A. *Schöngastia* (*Ascoschöngastia*) *rattus* (Wom. and Heasp., 1943). Venter.

B–E. *Schöngastia* (*Ascoschöngastia*) *lorius* (Gunther, 1939). B, dorsum; C, venter; D, scutum (× 500); E, palp.

F–I. *Schöngastia* (*Ascoschöngastia*) *indica* (Hirst, 1915). F, dorsum; G, scutum (× 500); H, tip of chelicera; I, palp.

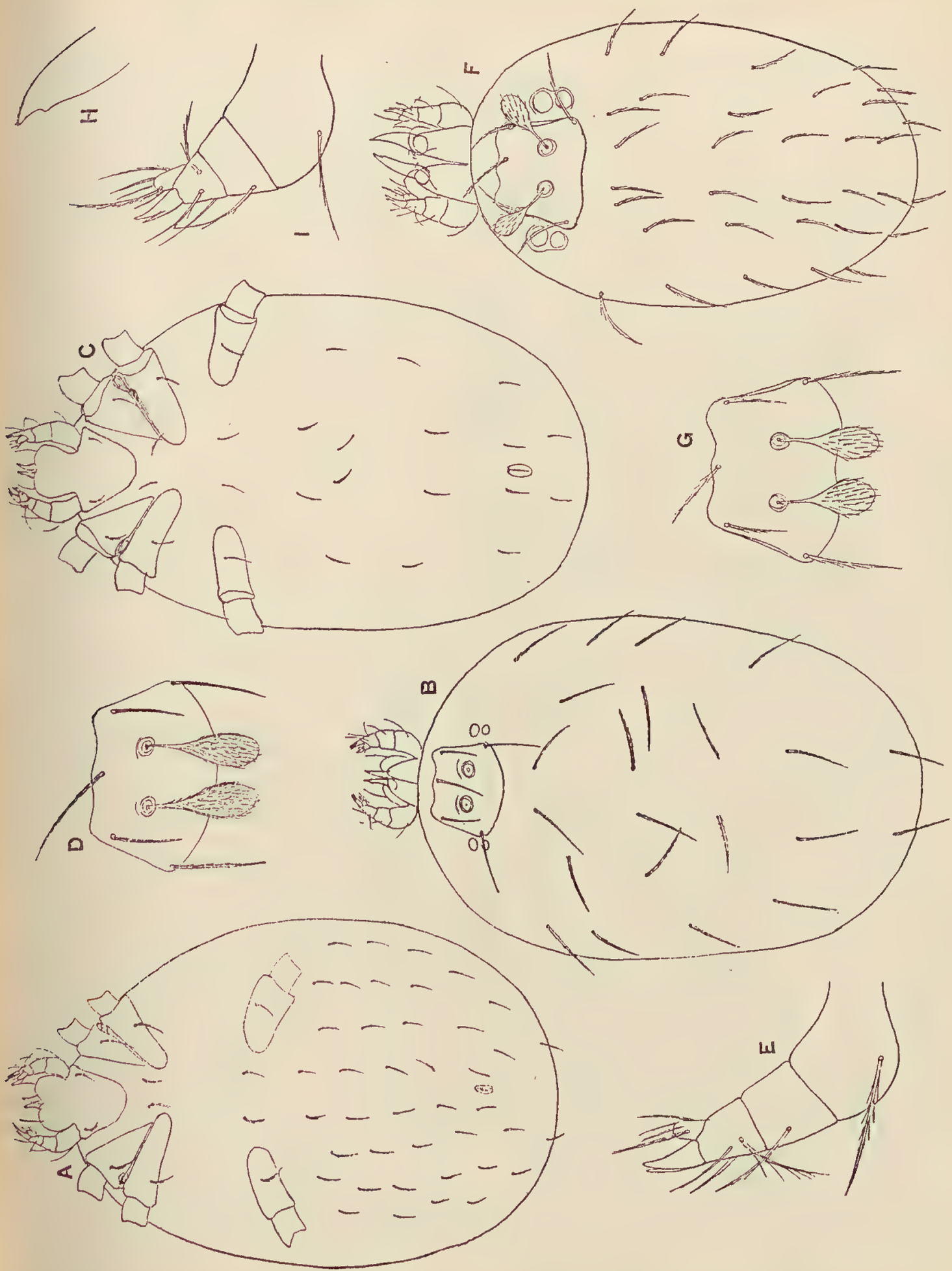

PLATE 55.

PLATE 56.

A. *Schöngastia* (*Ascoschöngastia*) *indica* Hirst, 1915. Venter.

B–F. *Schöngastia* (*Ascoschöngastia*) *soekaboemiensis* (Takekawa, 1945). B, dorsum; C, venter; D, scutum (× 500); E, tip of chelicera; F, palp.

G–I. *Schöngastia* (*Ascoschöngastia*) *perameles* (Wom. 1939). G, dorsum; H, scutum (× 500); I, palp.

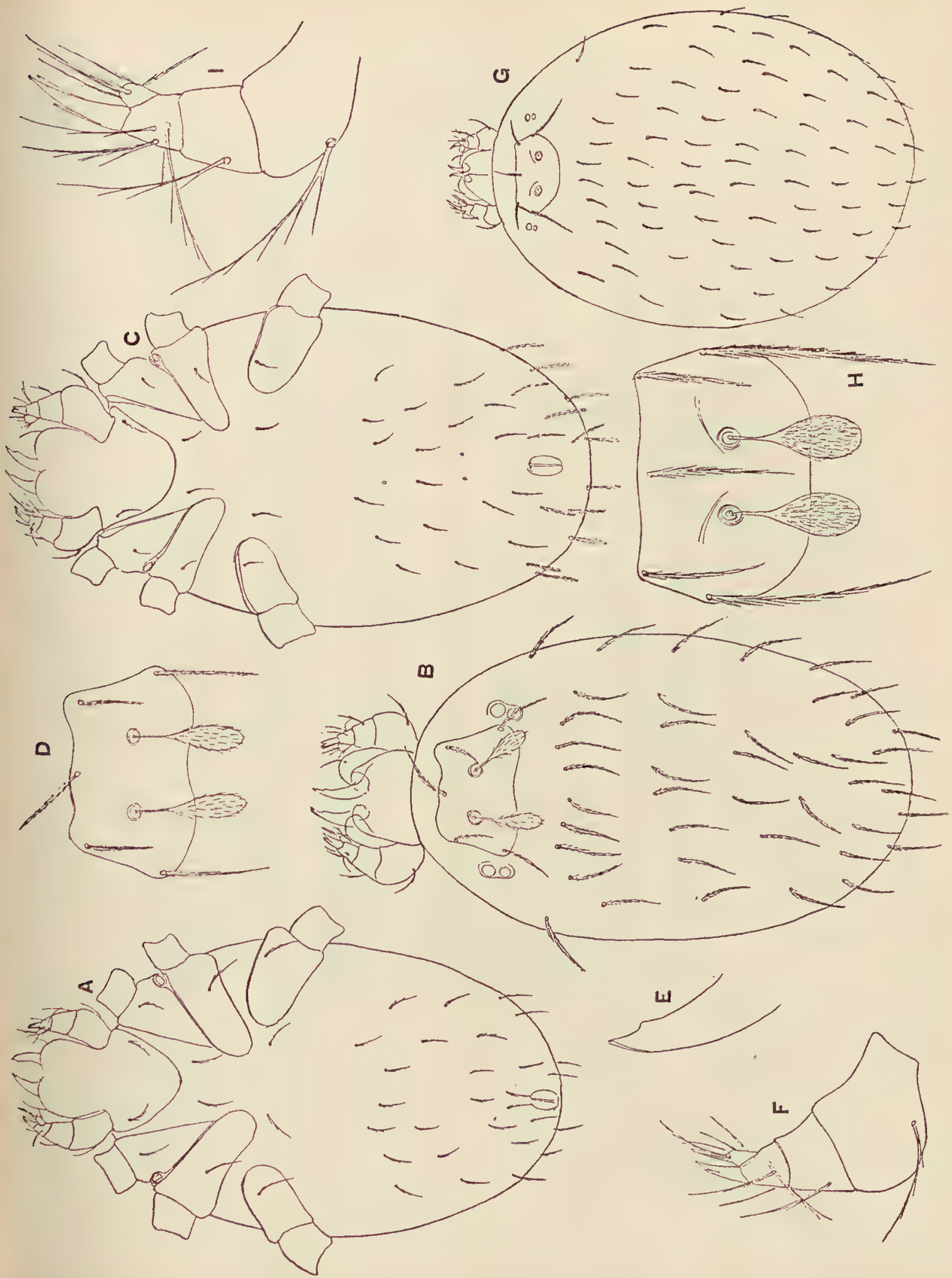

PLATE 56.

PLATE 57.

A. *Schöngastia* (*Ascoschöngastia*) *perameles* (Wom., 1939). Venter.

B. *Schöngastia* (*Ascoschöngastia*) *labuanensis* sp. n. Tarsus and metatarsus of leg III.

C. *Schöngastia* (*Ascoschöngastia*) *rattus* (Wom. and Heasp., 1943). Tarsus and metatarsus of leg III.

D. *Schöngastia* (*Ascoschöngastia*) *audyi* sp. n. Tarsus and metatarus of leg III.

E. *Schöngastia* (*Ascoschöngastia*) *lorius* (Gunther, 1939). Tarsus and metatarsus of leg III.

F. *Schöngastia* (*Ascoschöngastia*) *sockaboemiensis* (Takekawa, 1945). Tarsus and metatarsus of leg III.

G. *Schöngastia* (*Ascoschöngastia*) *indica* (Hirst, 1915). Tarsus and metatarsus of leg III.

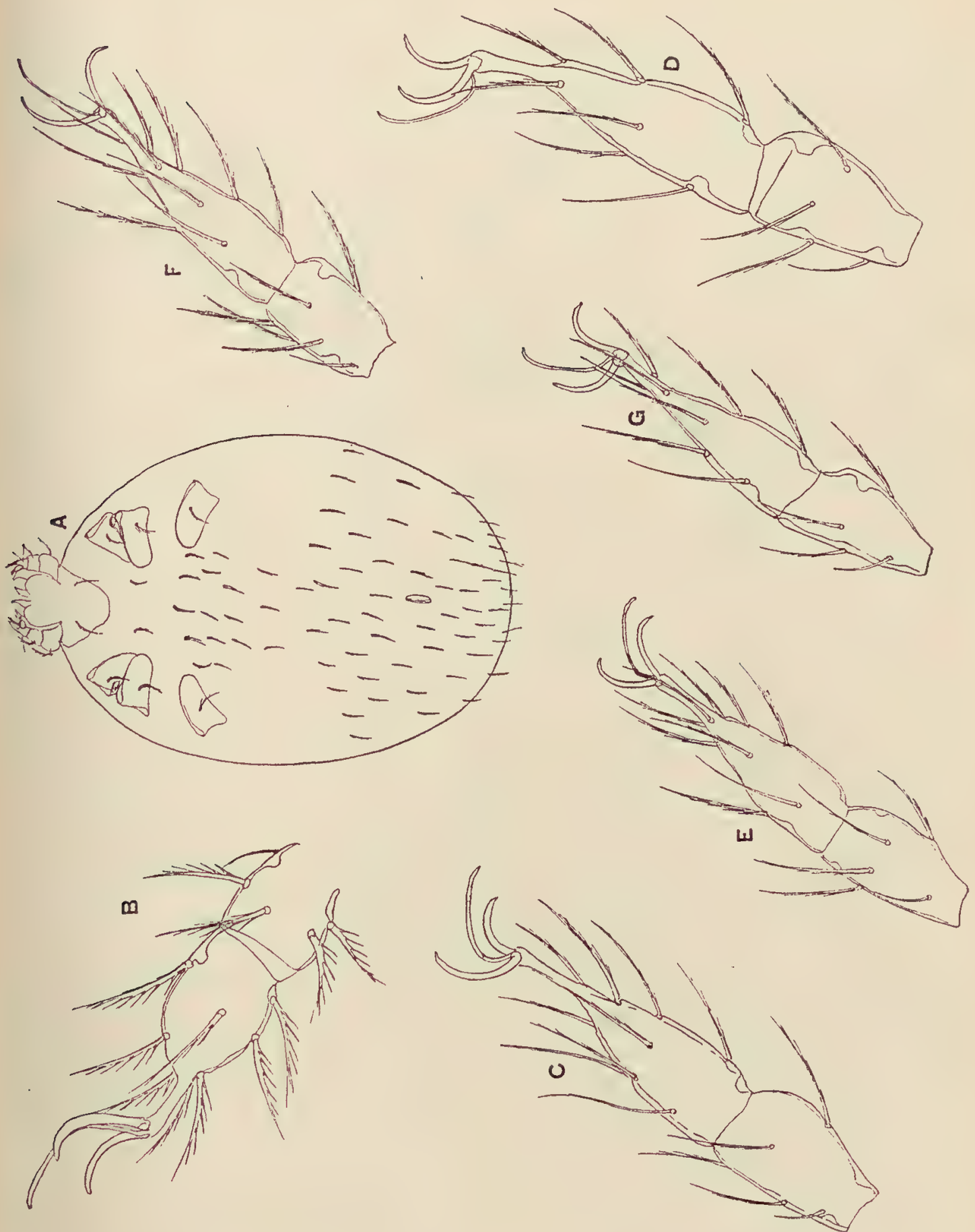

PLATE 57.

PLATE 58.

A–E. Schöngastia (*Ascoschöngastia*) *similis* (Wom. and Heasp., 1943). A, dorsum; B, venter; C, scutum (× 500); D, tip of chelicera and galeal seta; E, palp.

F–I. *Schöngastia* (*Ascoschöngastia*) *derricki* (Wom., 1939). F, dorsum; G, venter; H, scutum (× 500); I, tip of chelicera and galeal seta.

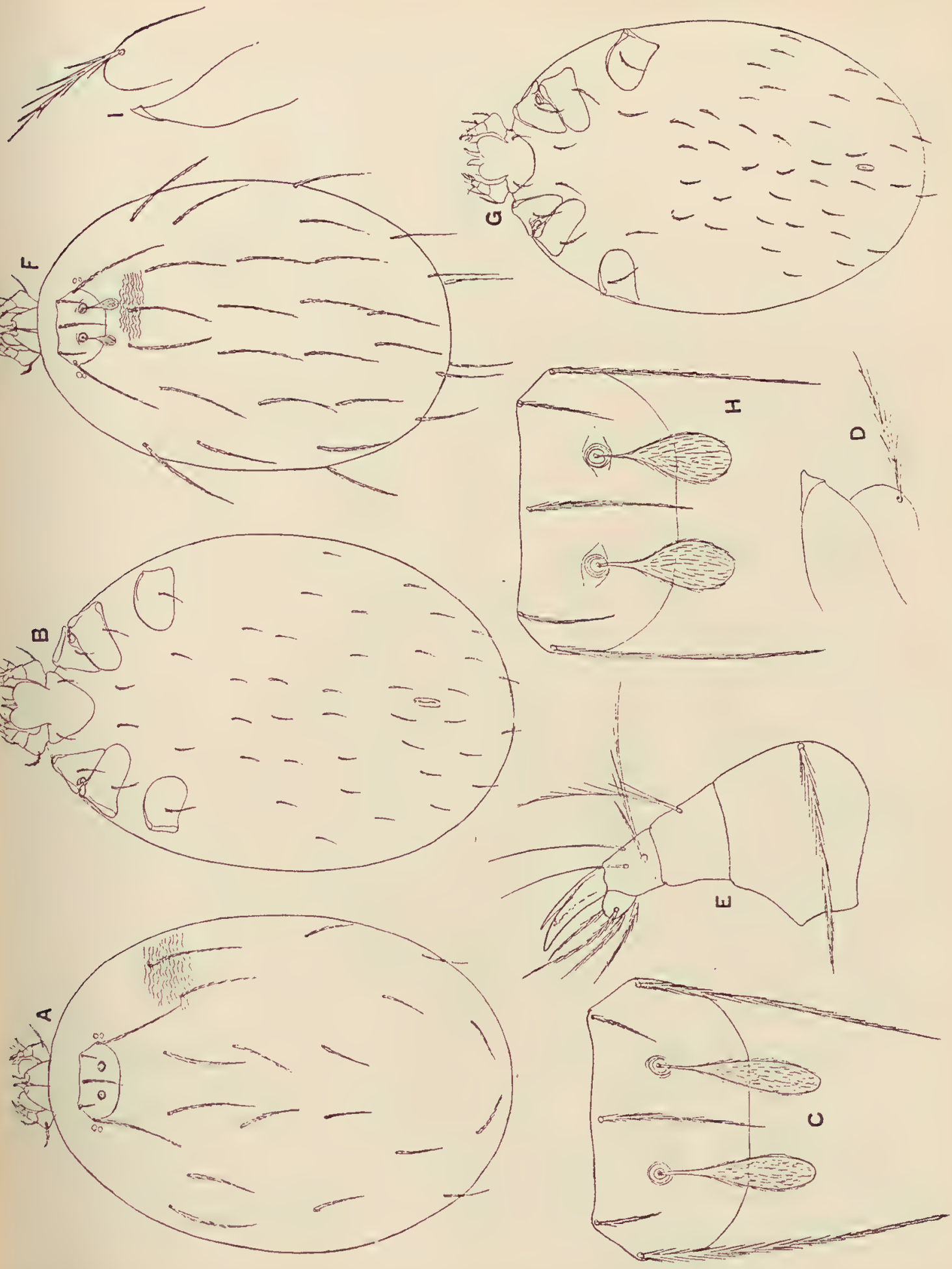

PLATE 58.

PLATE 59.

A. *Schöngastia* (*Ascoschöngastia*) *derricki* (Wom., 1939). Palp.

B–E. *Schöngastia* (*Ascoschöngastia*) *dasycerci* (Hirst, 1929). B, dorsum; C, venter; D, scutum (× 500); E, palp.

F–J. *Schöngastia* (*Ascoschöngastia*) *trichosuri* (Wom., 1939); F, dorsum; G, venter; H, scutum (× 500); I, palp; J, tip of chelicera and galeal seta.

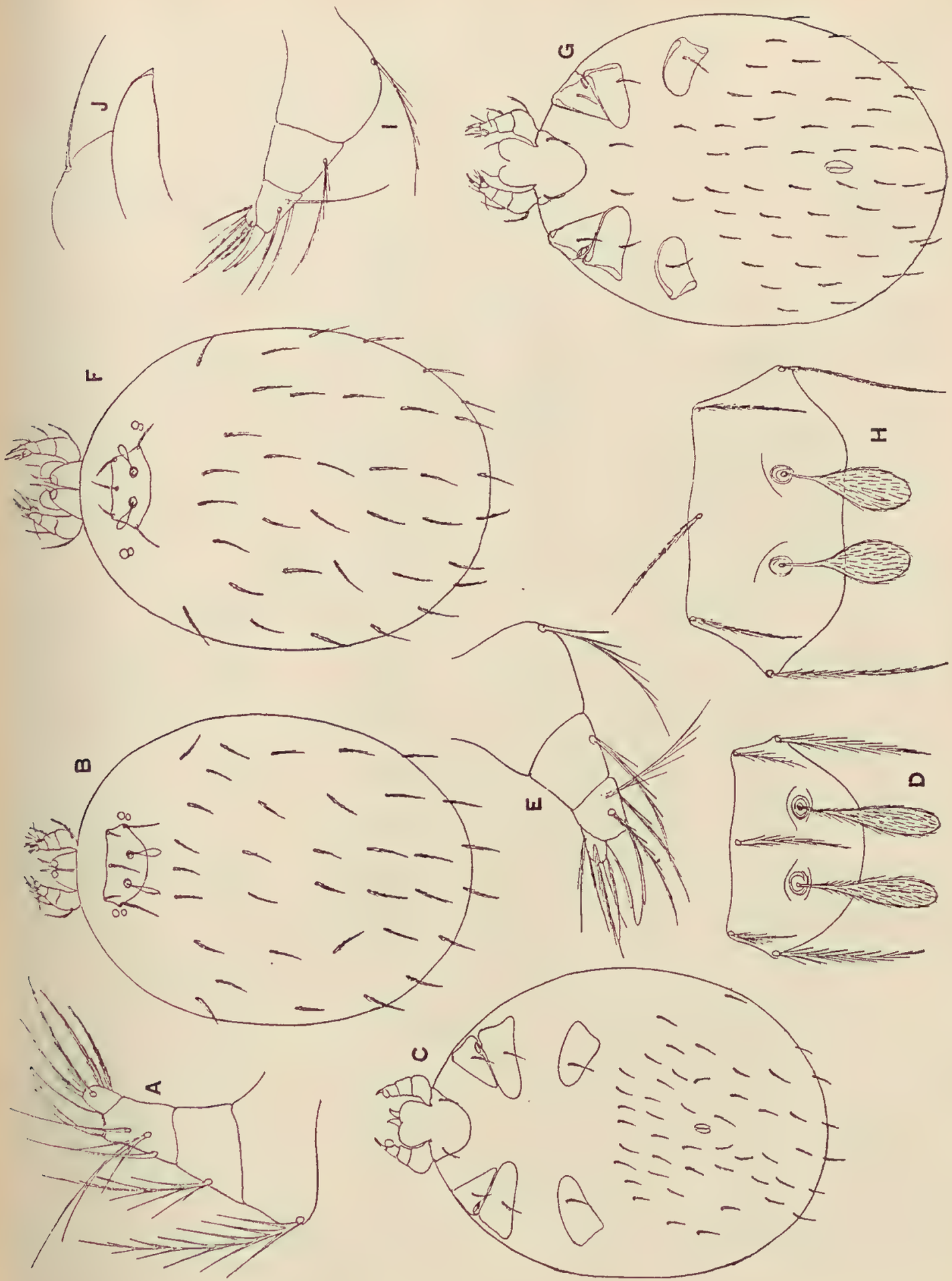

PLATE 59.

PLATE 60.

A–E. *Schöngastia (Ascoschöngastia) hirsti* (Wom. and Heasp., 1943). A, dorsum; B, venter; C, scutum (× 500); D, chelicera and galeal seta; E, palp.

F–J. *Schöngastia (Ascoschöngastia) phascogale* (Wom. and Heasp., 1943). F, dorsum; G, venter; H, scutum (× 500); I, palp; J, tip of chelicera and galeal seta.

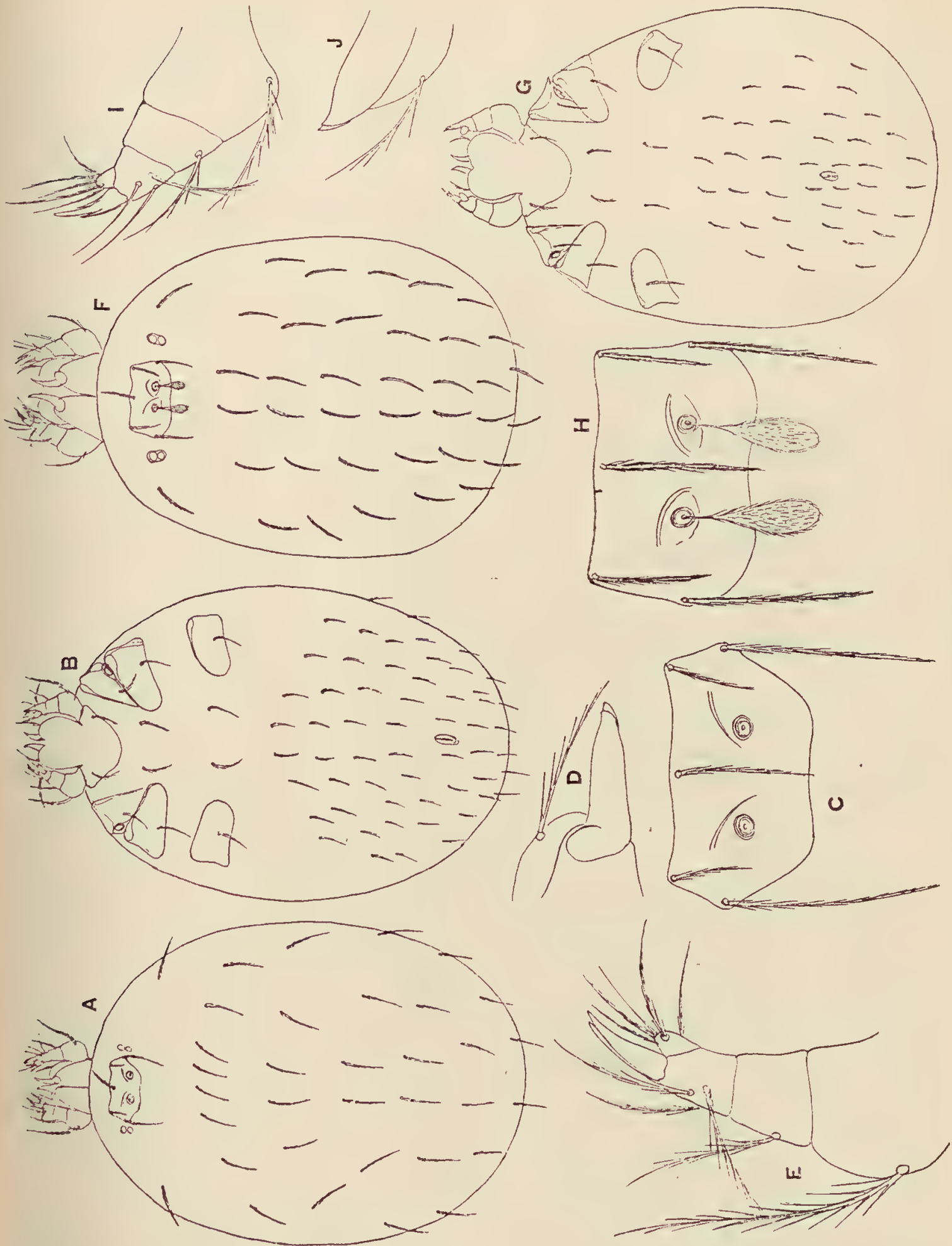

PLATE 60.

PLATE 61.

A–E. *Schöngastia (Ascoschöngastia) westraliensis* (Wom., 1934). A, dorsum; B, venter; C, tip of chelicera and galeal seta; D, palp; E, scutum (× 500).

F–J. *Schöngastia (Ascoschöngastia) peregrina* sp. n. F, venter; G, dorsum; H, scutum (× 500); I, tip of chelicera and galeal seta; J, palp.

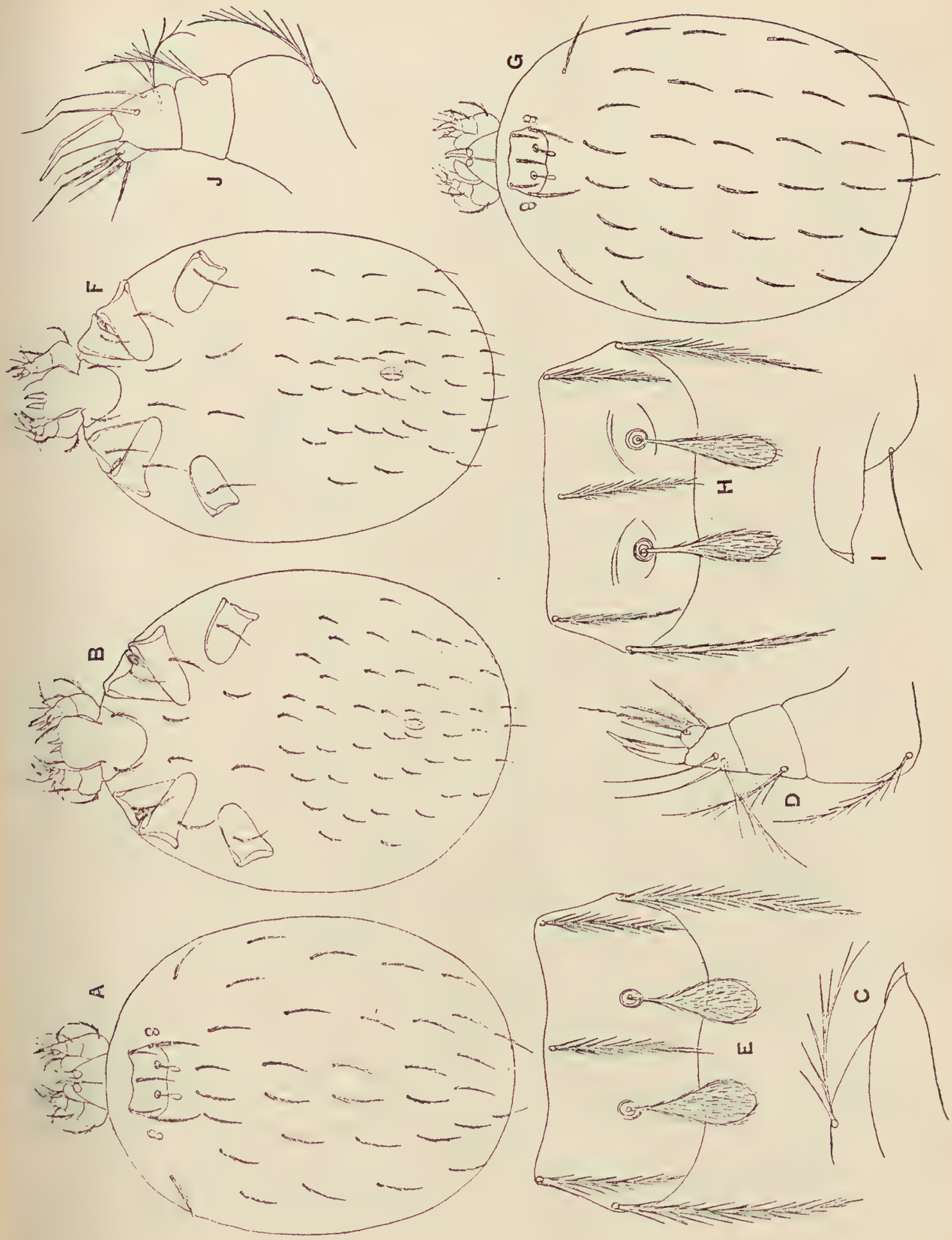

PLATE 61.

PLATE 62.

A–E. *Schöngastia (Ascoschöngastia) heaslipi* (Wom. and Heasp., 1943). A, dorsum; B, venter; C, tip of chelicera and galeal seta; D, palp; E, scutum (× 500).

F–I. *Schöngastia (Ascoschöngastia) traubi* sp. n. F, dorsum; G, venter; H, scutum (× 500); I, palp.

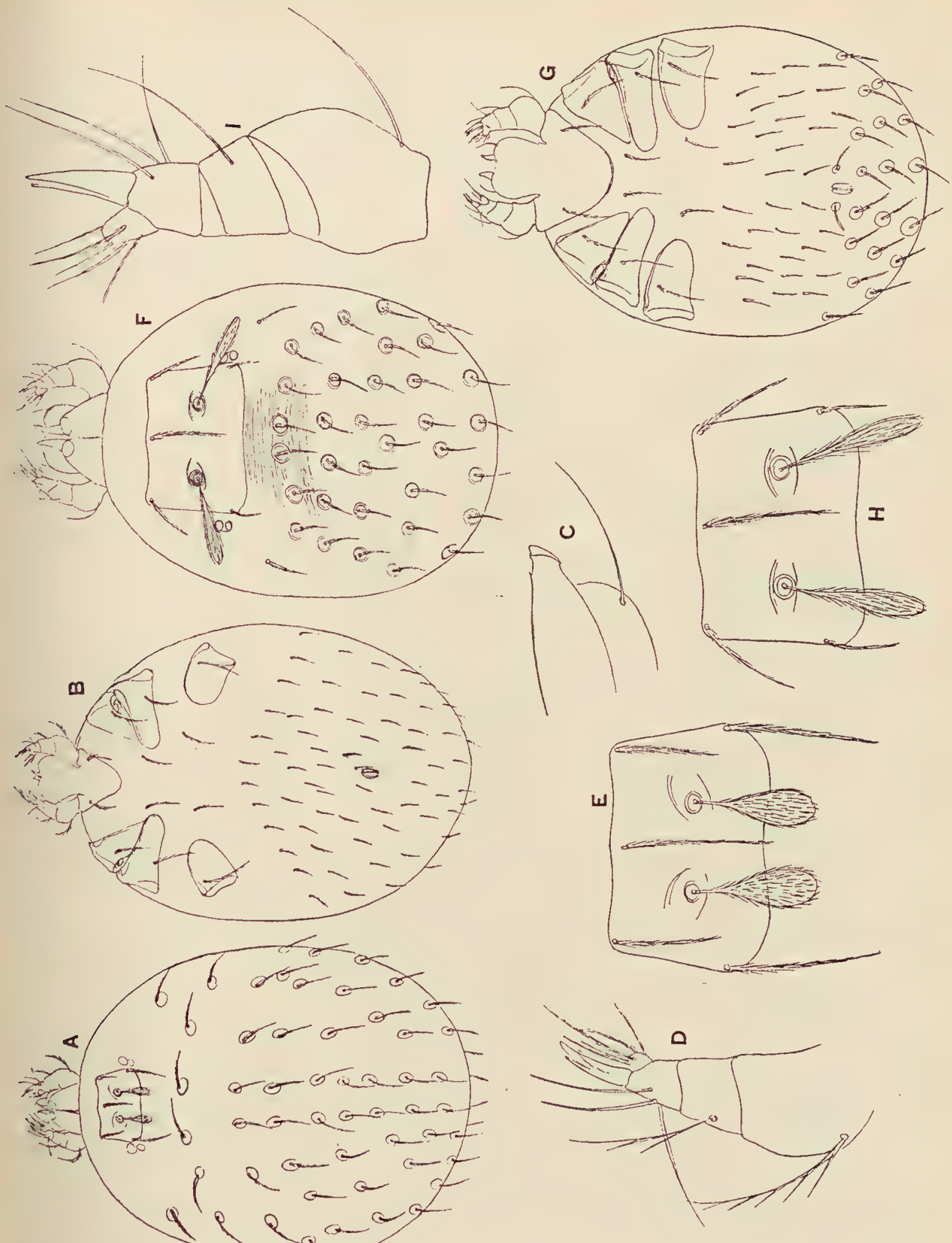

PLATE 62.

PLATE 63.

A–E. *Schöngastia (Ascoschöngastia) lawrencei* nom. nov. for *guntheri* (Wom. and Heasp., 1943), preoc. A, dorsum; B, venter; C, tip of chelicera and galeal seta; D, palp; E, scutum (× 500).

F–J. *Schöngastia (Ascoschöngastia) wongabelensis* sp. n. F, dorsum; G, venter; H, scutum (× 500); I, palp; J, tip of chelicera and galeal seta.

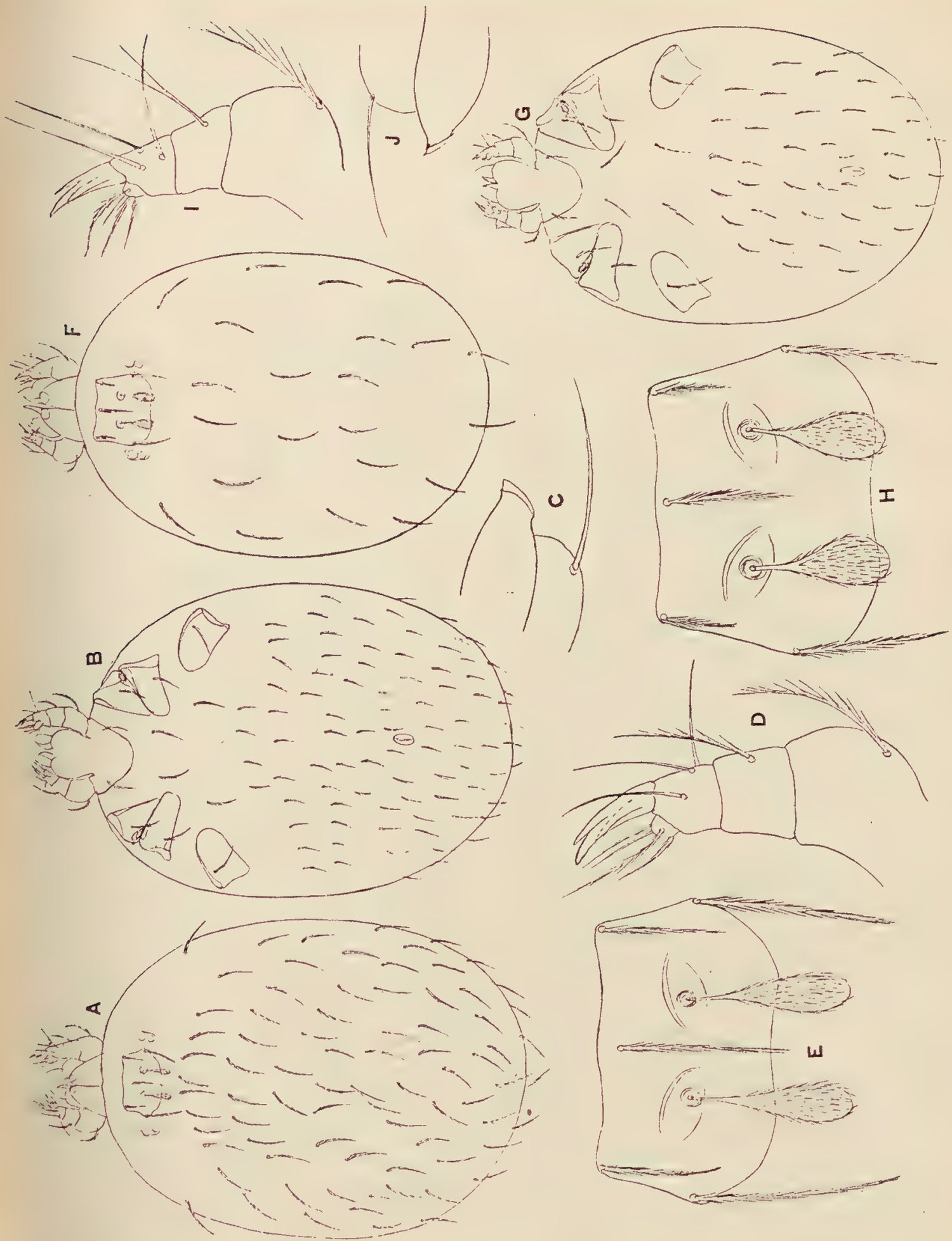

PLATE 63.

PLATE 64.

A–D. *Schöngastia* (*Ascoschöngastia*) *raui* sp. n. A, dorsum; B, venter; C, scutum (× 500); D, palp.

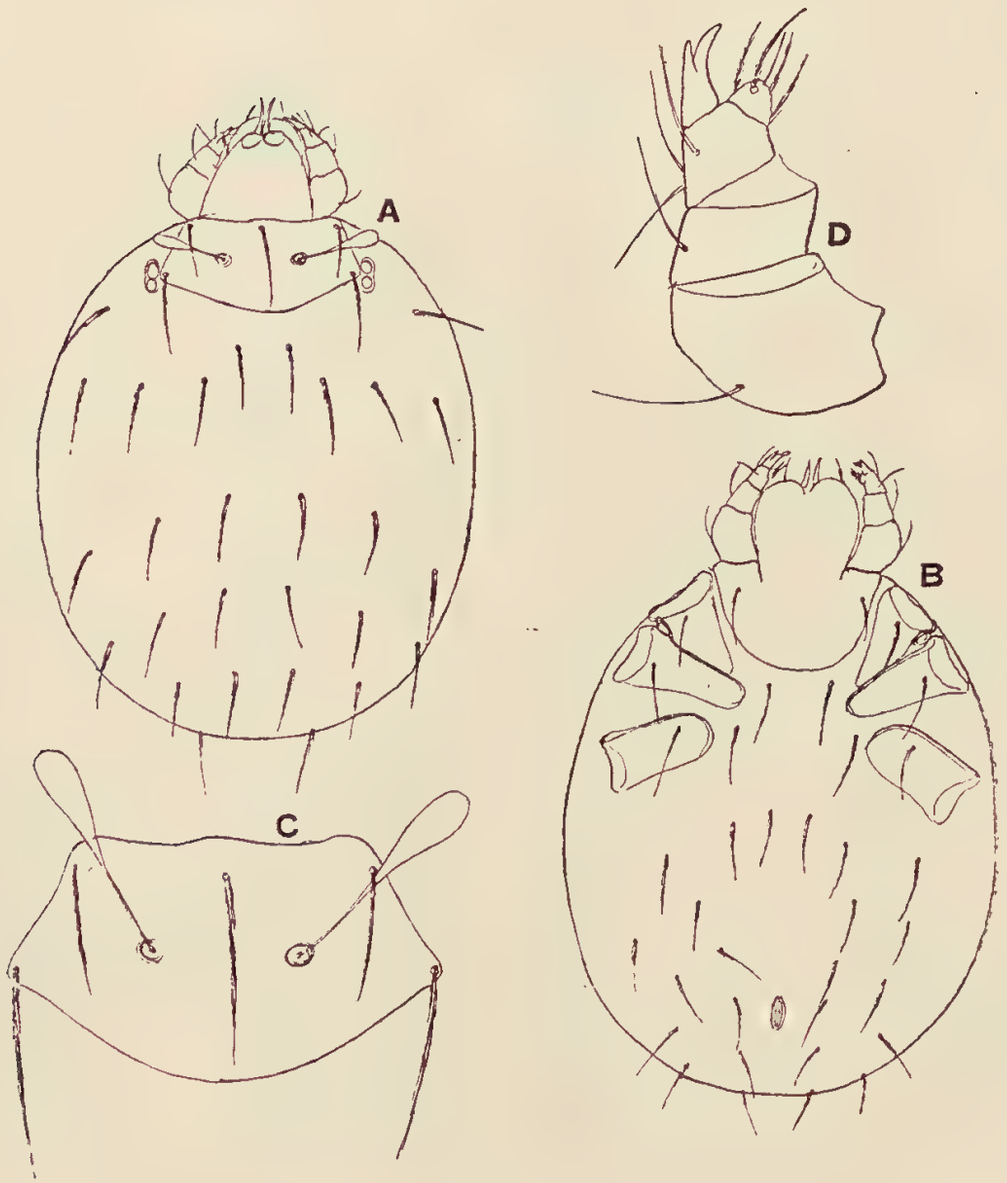

PLATE 64.

PLATE 65.

A–E. *Schöngastia (Ascoschöngastia) smithi* (Wom., 1939). A, dorsum; B, venter; C, scutum (× 500); D, palp; E, tip of chelicera and galeal seta.

F–J. *Schöngastia (Ascoschöngastia) cairnsensis* (Wom. and Heasp., 1943). F, dorsum; G, venter; H, scutum (× 500); I, palp; J, tip of chelicera and galeal seta.

K. *Schöngastia (Ascoschöngastia) cairnsensis* v. *gateri* (Wom. and Heasp.).

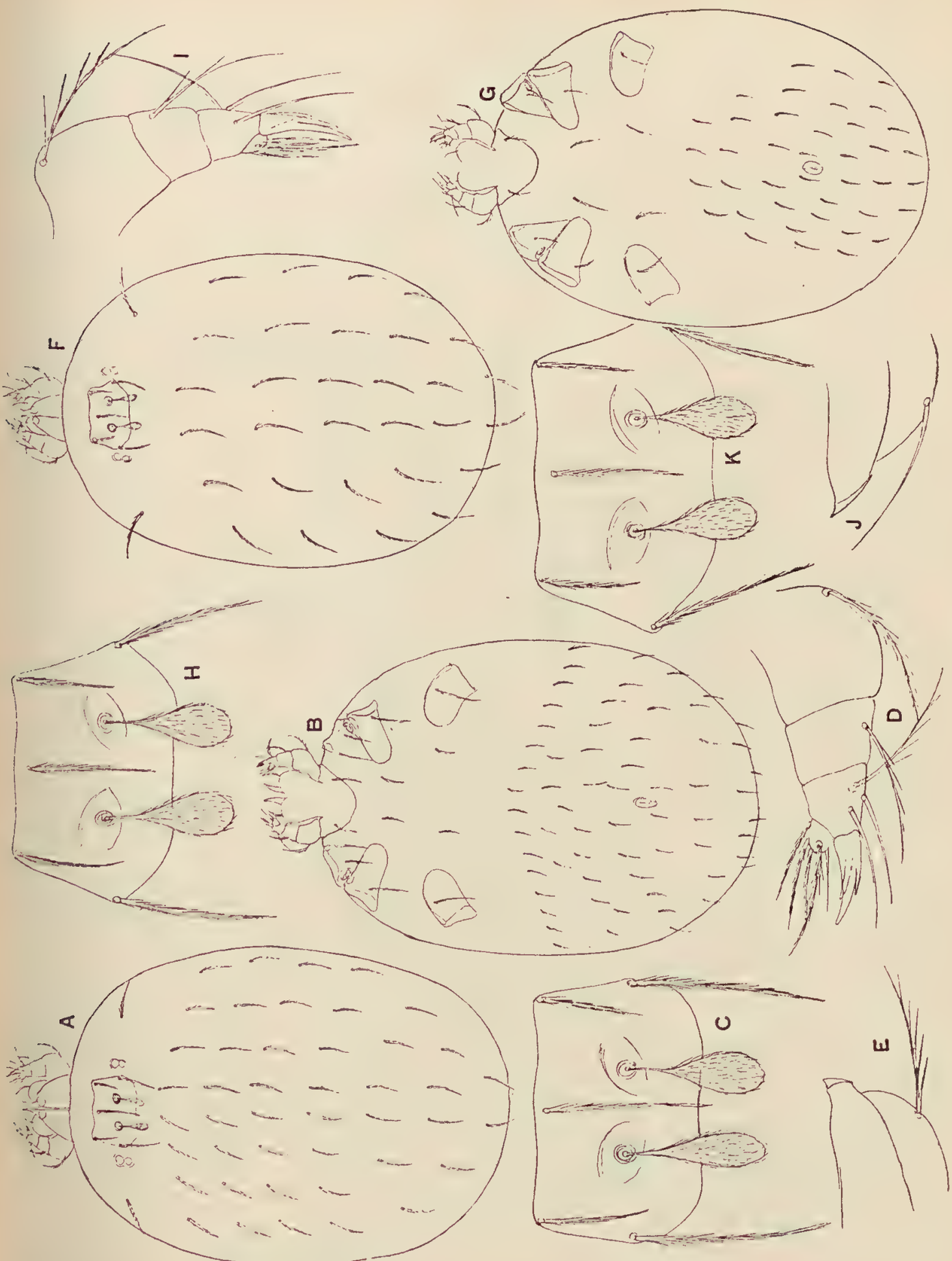

PLATE 65.

PLATE 66.

A–E. *Radfordiana rostrata* g. et sp. n. A, dorsum; B, venter; C, chelicera and galeal seta; D, palp; E, scutum (× 500).

F–J. *Oenoschöngastia cana* Wom. and Kohls, 1947. F, dorsum; G, venter; H, scutum (× 500); I, mandible; J, palp.

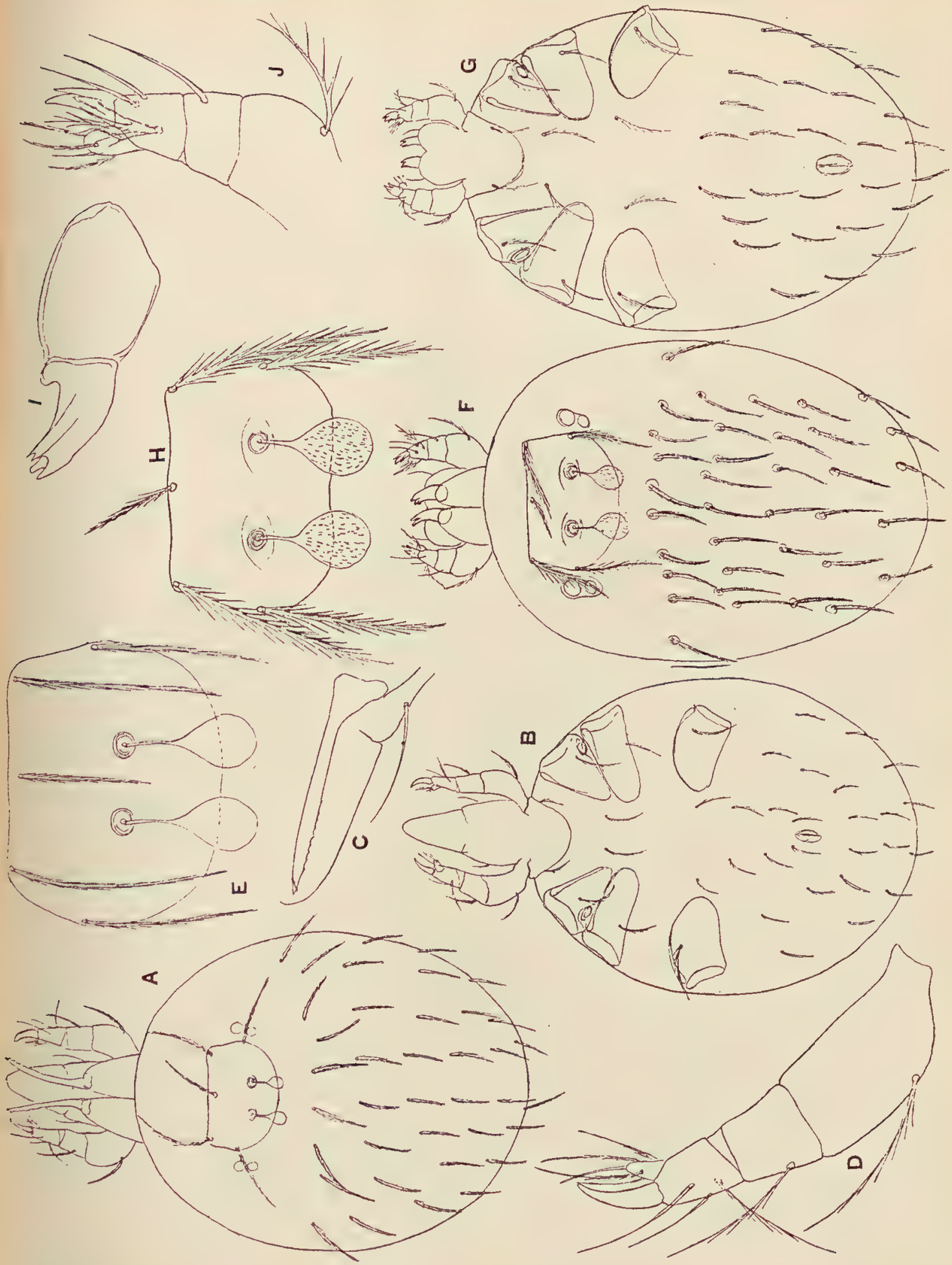

PLATE 66.

PLATE 67.

A–E. *Guntherana bipygalis* (Gunther, 1939), unfed, from N.G. A, dorsum; B, venter; C, tip of chelicera; D, palp; E, scutum (× 500).

F–H. *Guntherana bipygalis* (Gunther, 1939), engorged, from Queensland. F, dorsum; G, venter; H, scutum (× 500).

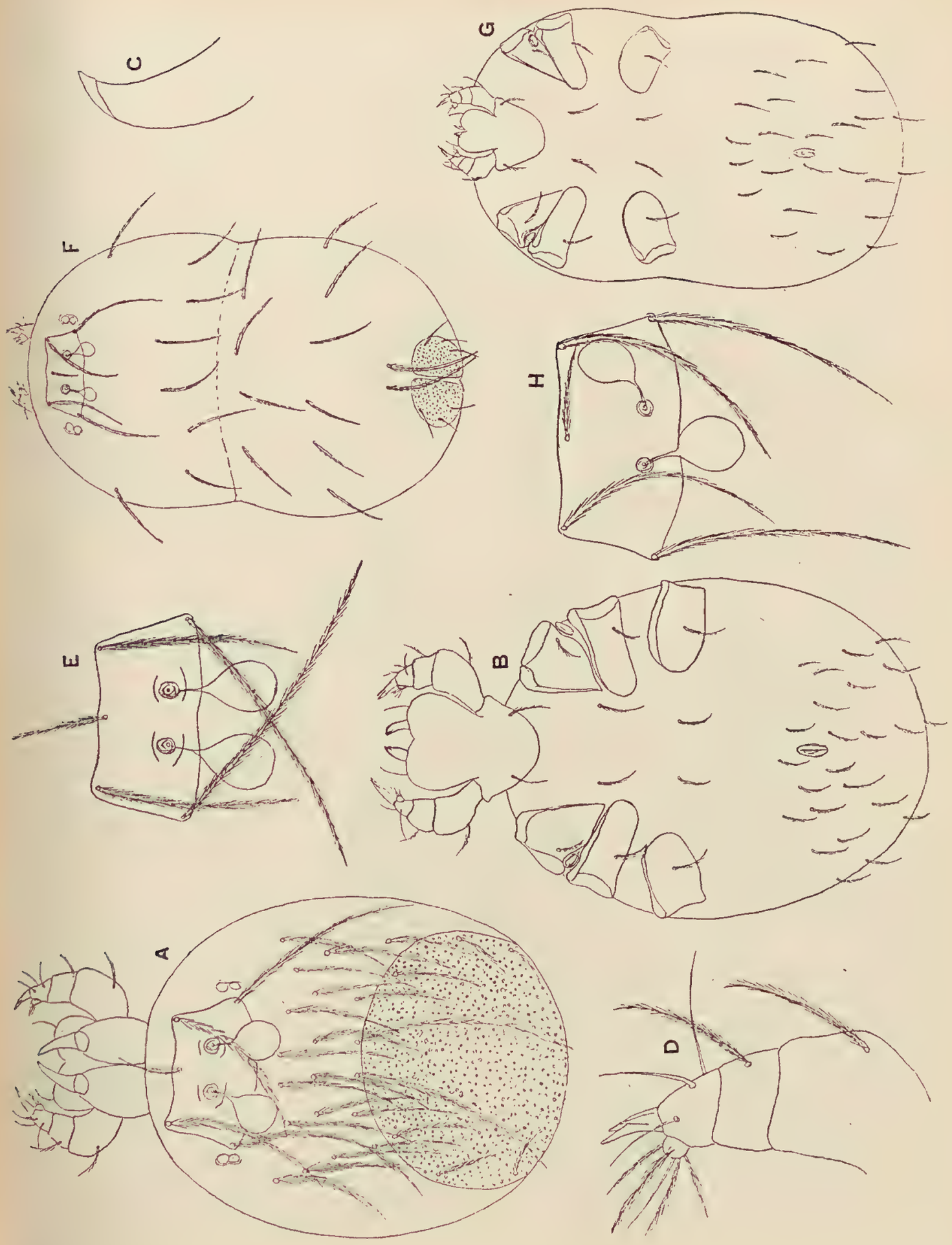

PLATE 67.

PLATE 68.

A–D. *Schöngastia* (*Ascoschöngastia*) *masta* (Traub and Sundermeyer, 1950). A, dorsum; B, venter; C, scutum (× 500); D, palp (after Traub and Sundermeyer).

E–I. *Mackiena empodiformis* Traub and Evans, 1950. E, dorsum; F, venter; G, scutum (× 500); H, palp; I, tarsus and metatarsus of leg III (after Traub and Evans).

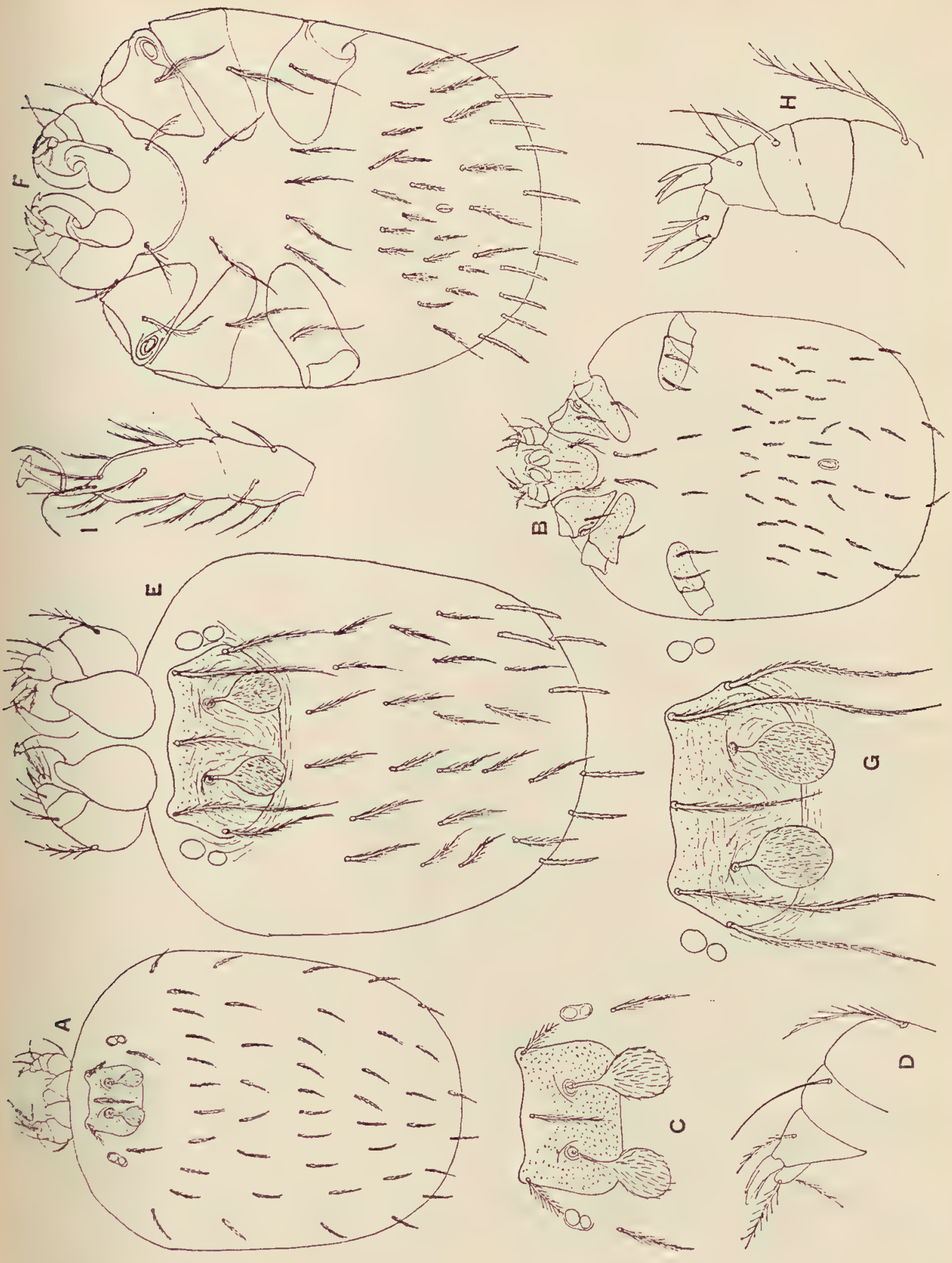

PLATE 68.

PLATE 69.

A–E. *Neoschöngastia gallinarum* (Hatori, 1920). A, dorsum; B, venter; C, scutum (× 500); D, tip of chelicera; E, palp.

F–J. *Neoschöngastia backhousei* Gunther, 1939. F, dorsum; G, venter; H, scutum (× 500); I, dorsal seta; J, palp. (F–G after Gunther).

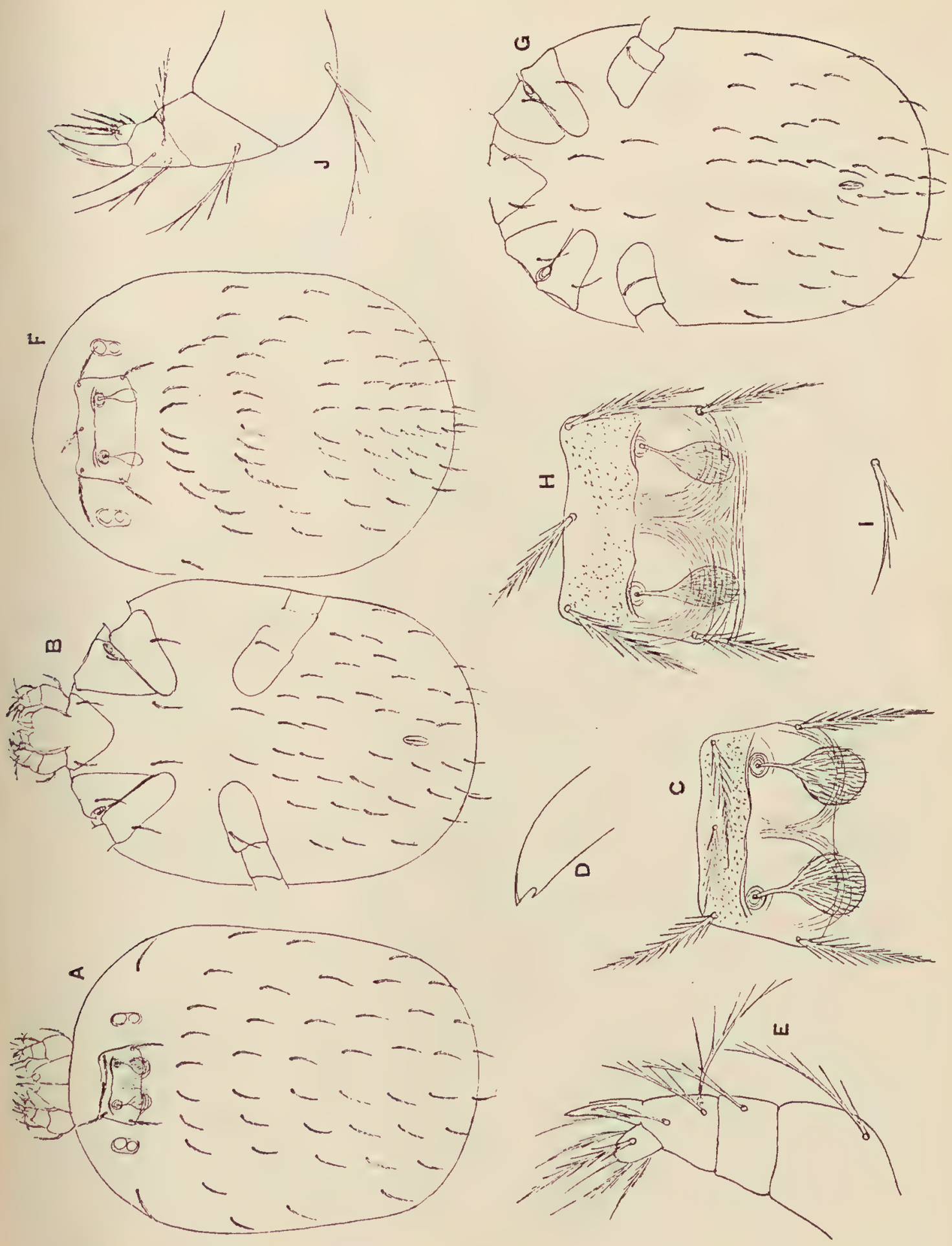

PLATE 69.

PLATE 70.

A–E. *Neoschöngastia retrocincta* Gunther, 1939. A, dorsum; B, venter; C, tip of chelicera and galeal seta; D, palp; E, scutum (× 500).

F–J. *Neoschöngastia struthidia* sp. n. F, dorsum; G, venter; H, scutum (× 500); I, tip of chelicera and galeal seta; J, palp.

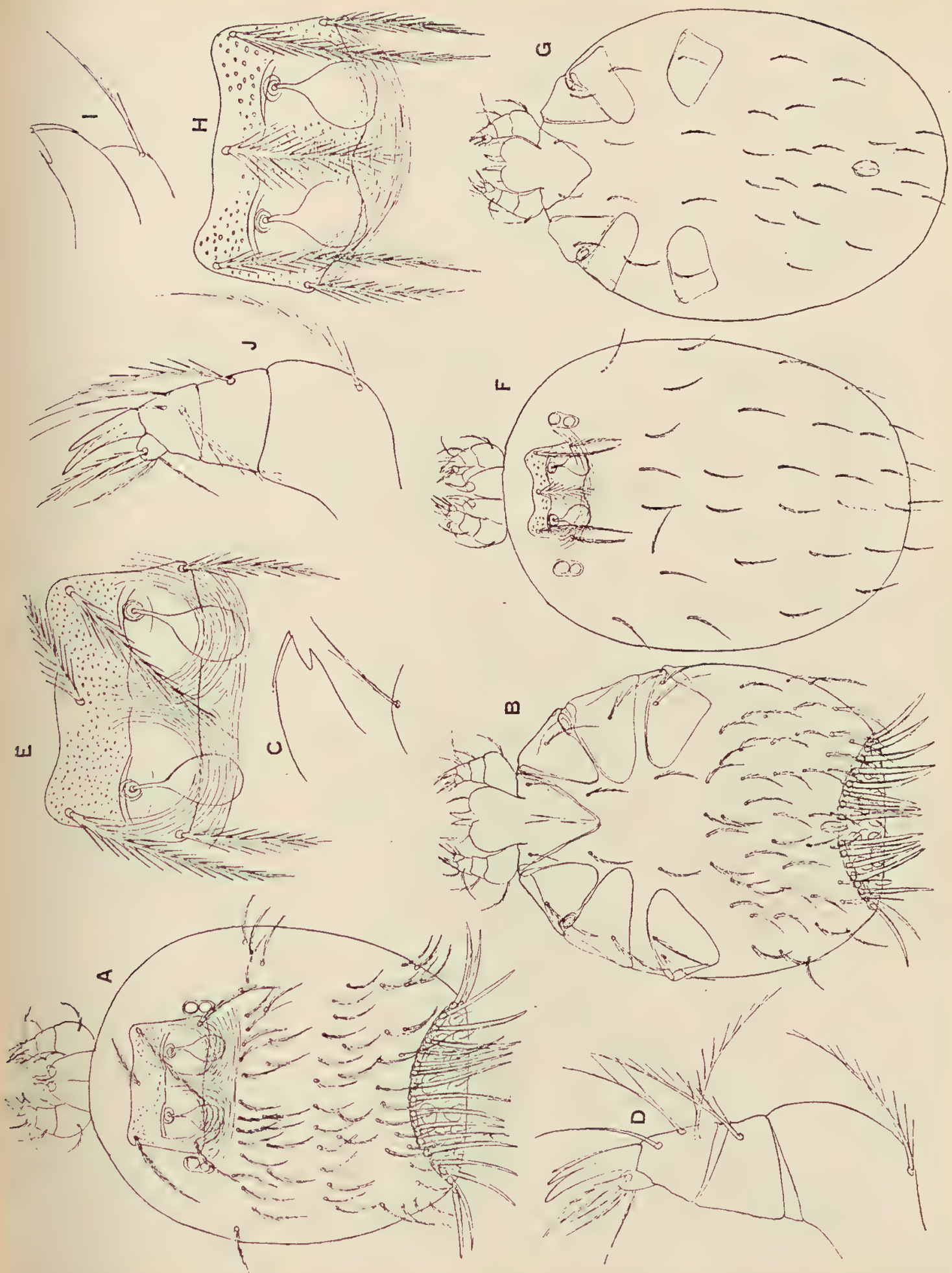

PLATE 70.

PLATE 71.

A–E. *Neoschöngastia yeomansi* Gunther, 1939. A, dorsum; B, venter; C, chelicera and galeal seta; D, palp; E, scutum (× 500).

F–H. *Neoschöngastia owiensis* sp. n. F, dorsum; G, venter; H, scutum (× 500).

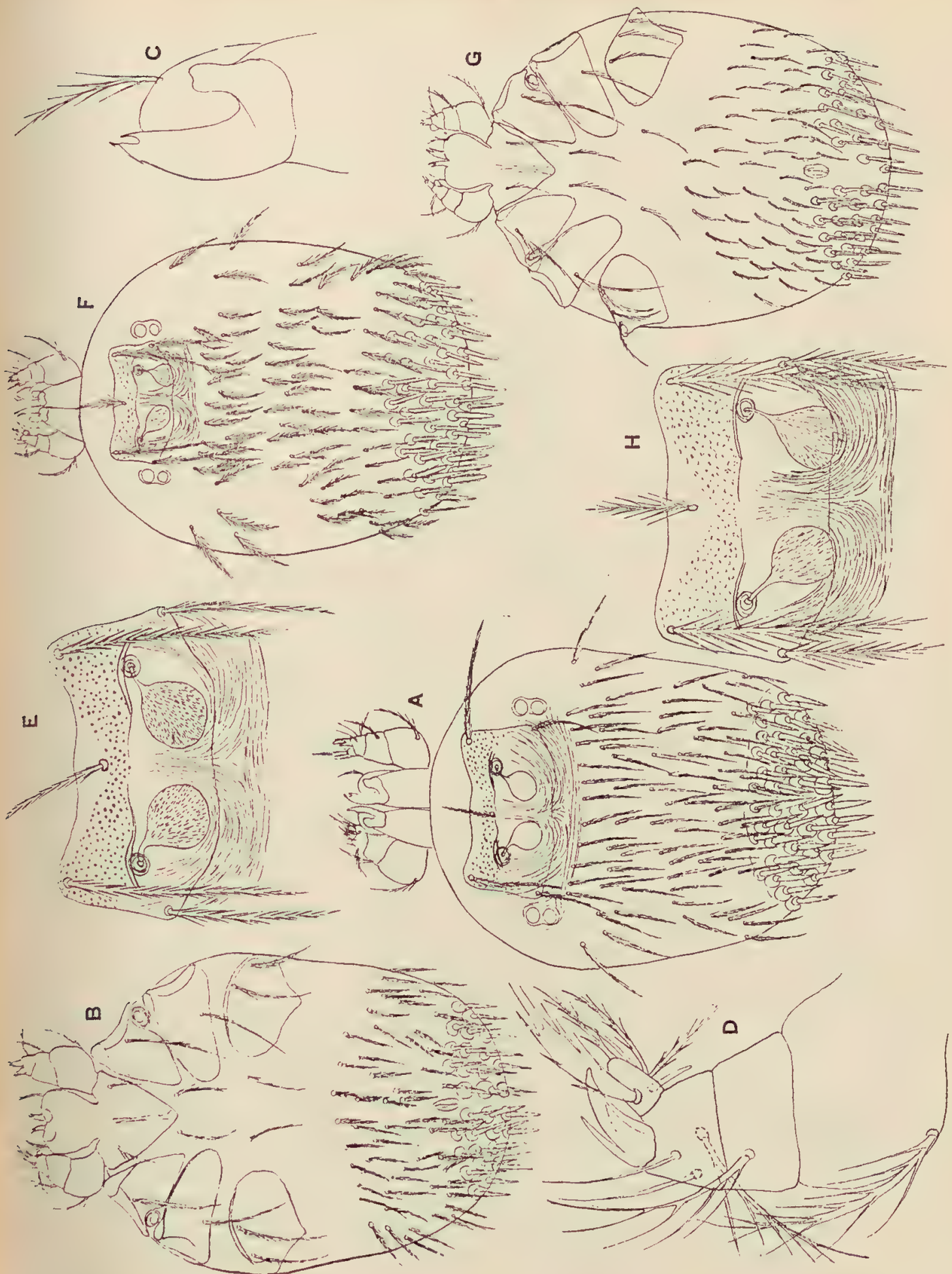

PLATE 71.

PLATE 72.

A–B. *Neoschöngastia owiensis* sp. n. A, chelicera and galeal seta; B, palp.

C–G. *Neoschöngastia mcqueeni* sp. n. C, dorsum; D, venter; E, scutum (× 500); F, palp; G, tip of chelicera and galeal seta.

H–K. *Neoschöngastia entomyza* sp. n. H, dorsum; I, venter; J, scutum (× 500); K, tip of chelicera and galeal seta.

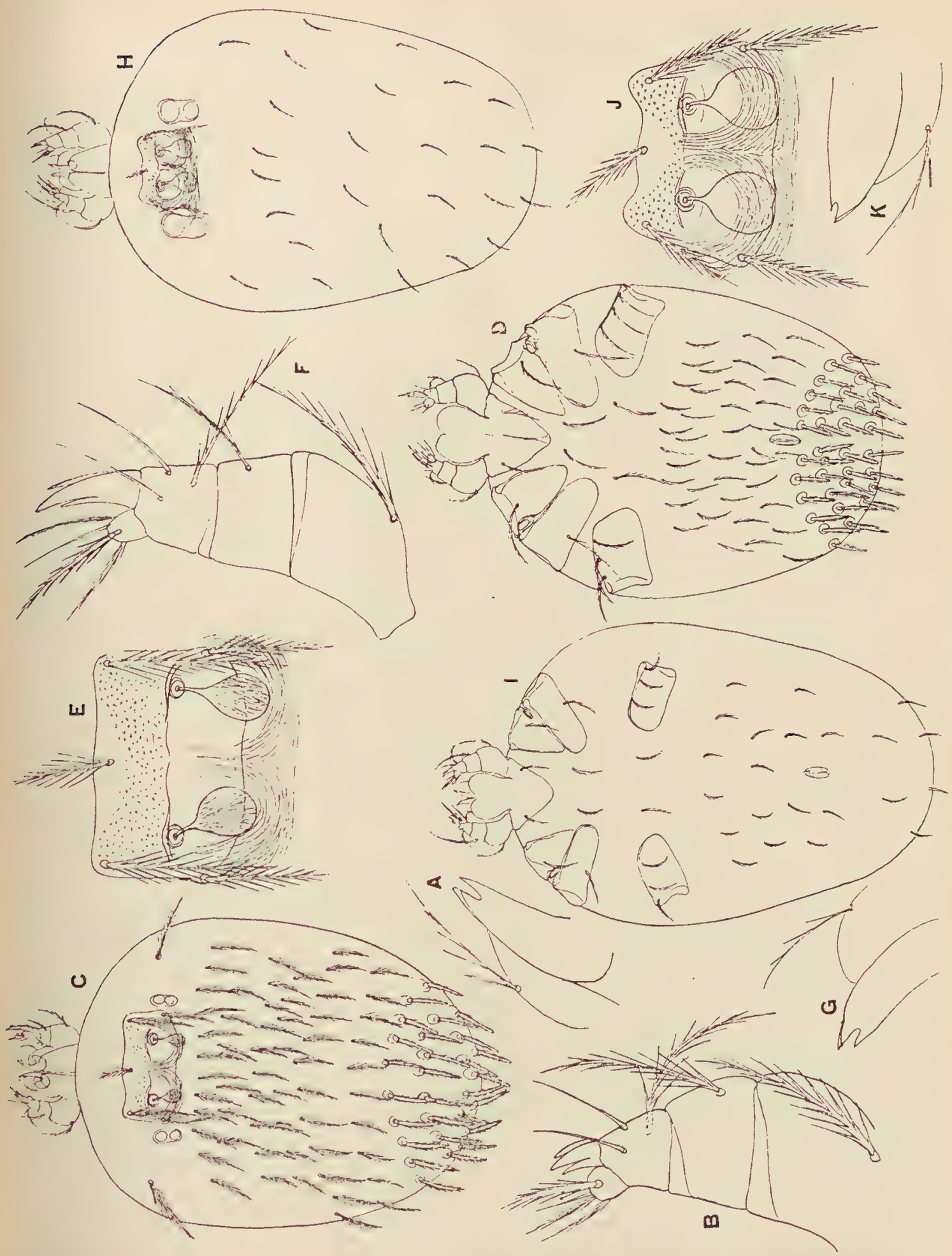

PLATE 72.

PLATE 73.

A. *Neoschöngastia entomyza* sp. n. Palp.

B–D. *Neoschöngastia thomasi* (Radford, 1946). B, dorsum; C, venter; D, scutum (× 500), (after Radford).

E–G. *Neoschöngastia salmi* (Ouds., 1912). E, dorsum; F, venter; G, scutum (× 500), (after Oudemans).

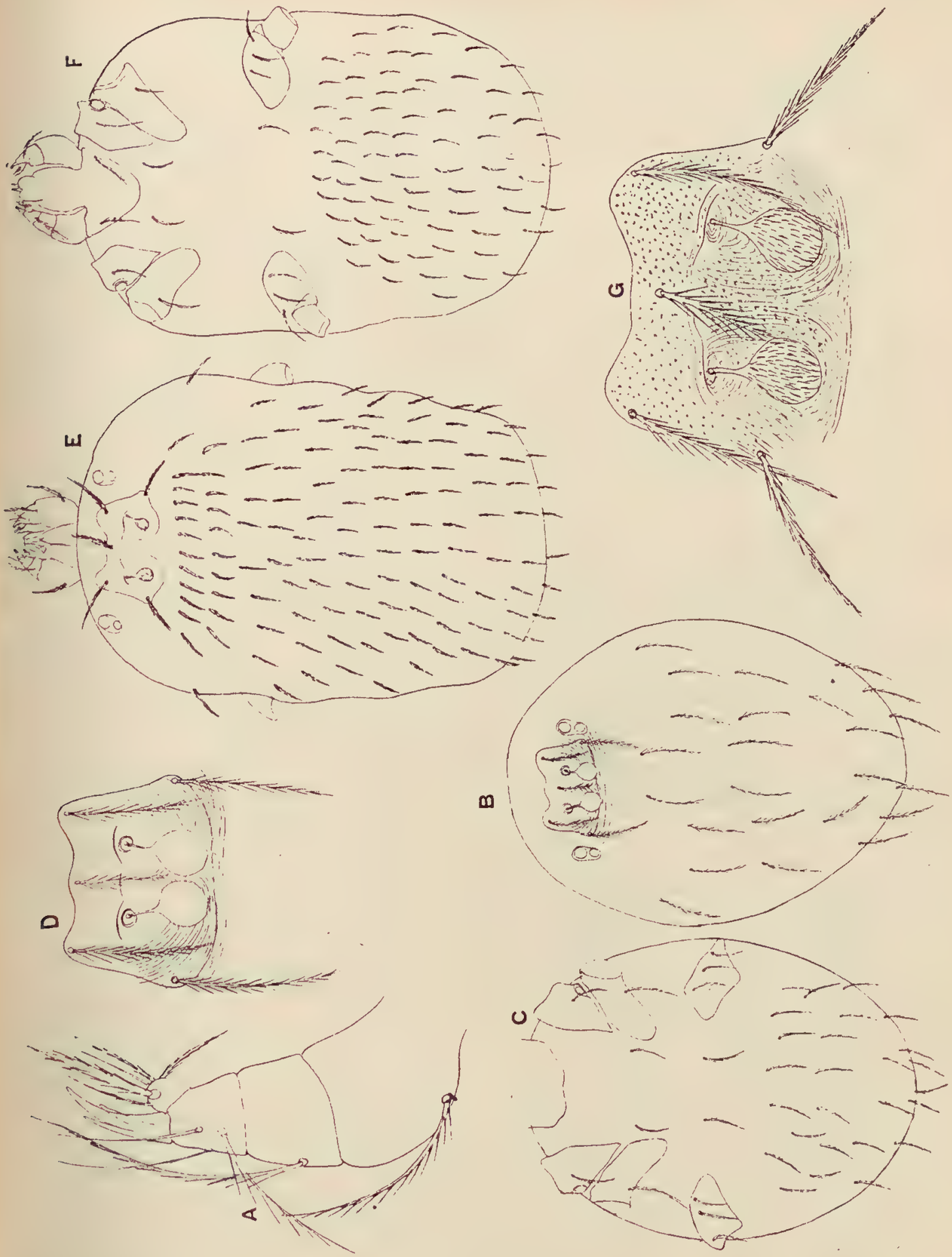

PLATE 73.

PLATE 74.

A–C. *Neoschöngastia dubia* Gunther, 1939. A, dorsum; B, venter; C, scutum (× 500), (after Gunther).

D. *Neoschöngastia americana solomonis* Wharton and Hardcastle, 1946. Scutum (× 500), (after Whart. and Hard.).

E. *Neoschöngastia bougainvillensis* Wharton and Hardcastle, 1946. Scutum (× 500), (after Whart. and Hard.).

F. *Neoschöngastia riversi* Wharton and Hardcastle, 1946. Scutum (× 500), (after Whart. and Hard.).

G. *Neoschöngastia egretta* Wharton and Hardcastle, 1946. Scutum (× 500), (after Whart. and Hard.).

H. *Neoschöngastia atollensis* Wharton and Hardcastle, 1946. Scutum (× 500), (after Whart. and Hard.).

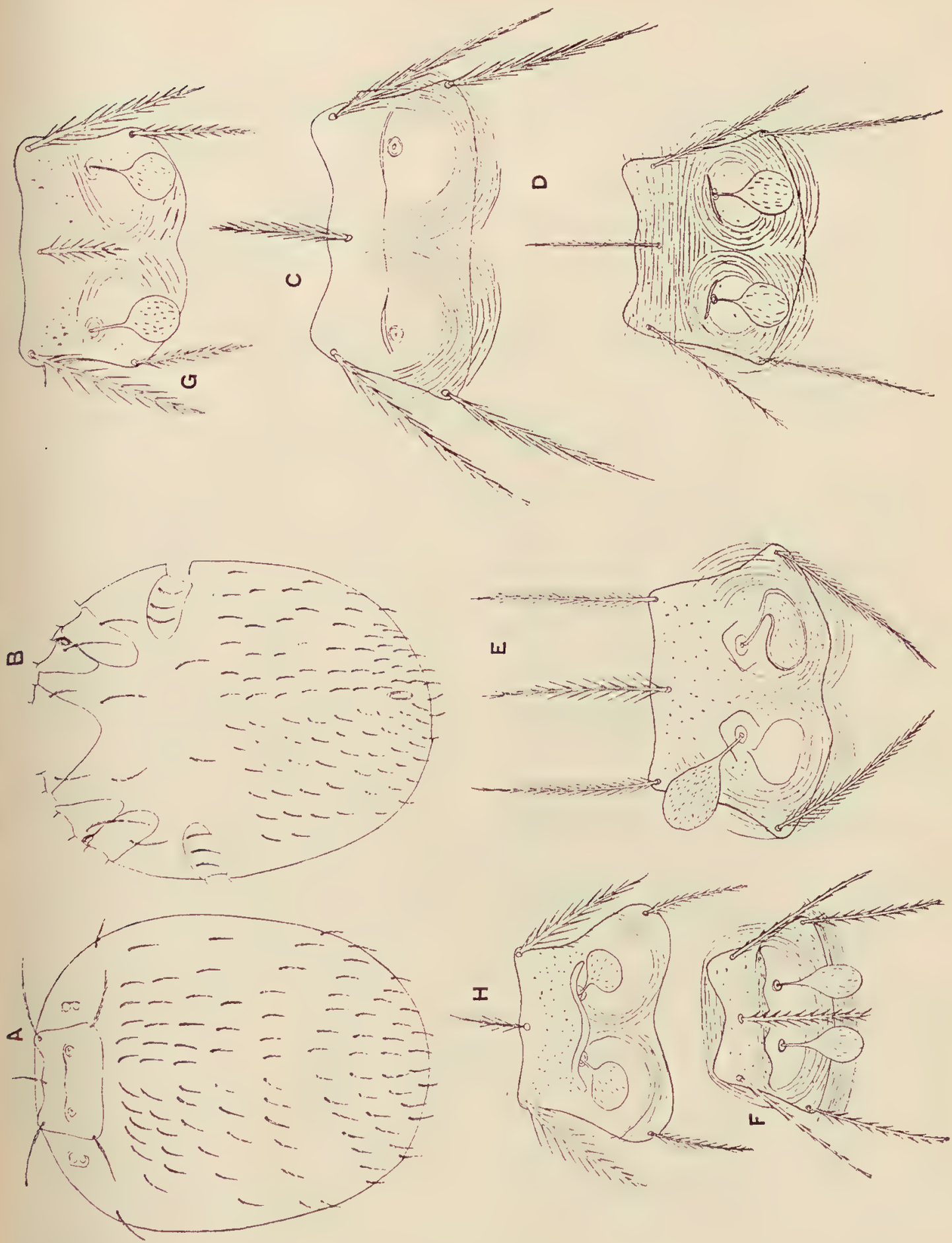

PLATE 74.

PLATE 75.

A. *Neoschöngastia posekanyi* Wharton and Hardcastle, 1946. Scutum (× 500), (after Whart. and Hard.).

B. *Neoschöngastia pauensis* Wharton and Hardcastle, 1946. Scutum (× 500), (after Whart. and Hard.).

C. *Neoschöngastia carveri* Wharton and Hardcastle, 1946. Scutum (× 500), (after Whart. and Hard.).

D. *Neoschöngastia monticola* Wharton and Hardcastle, 1946. Scutum (× 500), (after Whart. and Hard.).

E. *Neoschöngastia strongi* Wharton and Hardcastle, 1946. Scutum (× 500), (after Whart. and Hard.).

F. *Neoschöngastia ewingi* Wharton and Hardcastle, 1946. Scutum (× 500), (after Whart. and Hard.).

G. *Neoschöngastia namrui* Wharton and Hardcastle, 1946. Scutum (× 500); (after Whart. and Hard.).

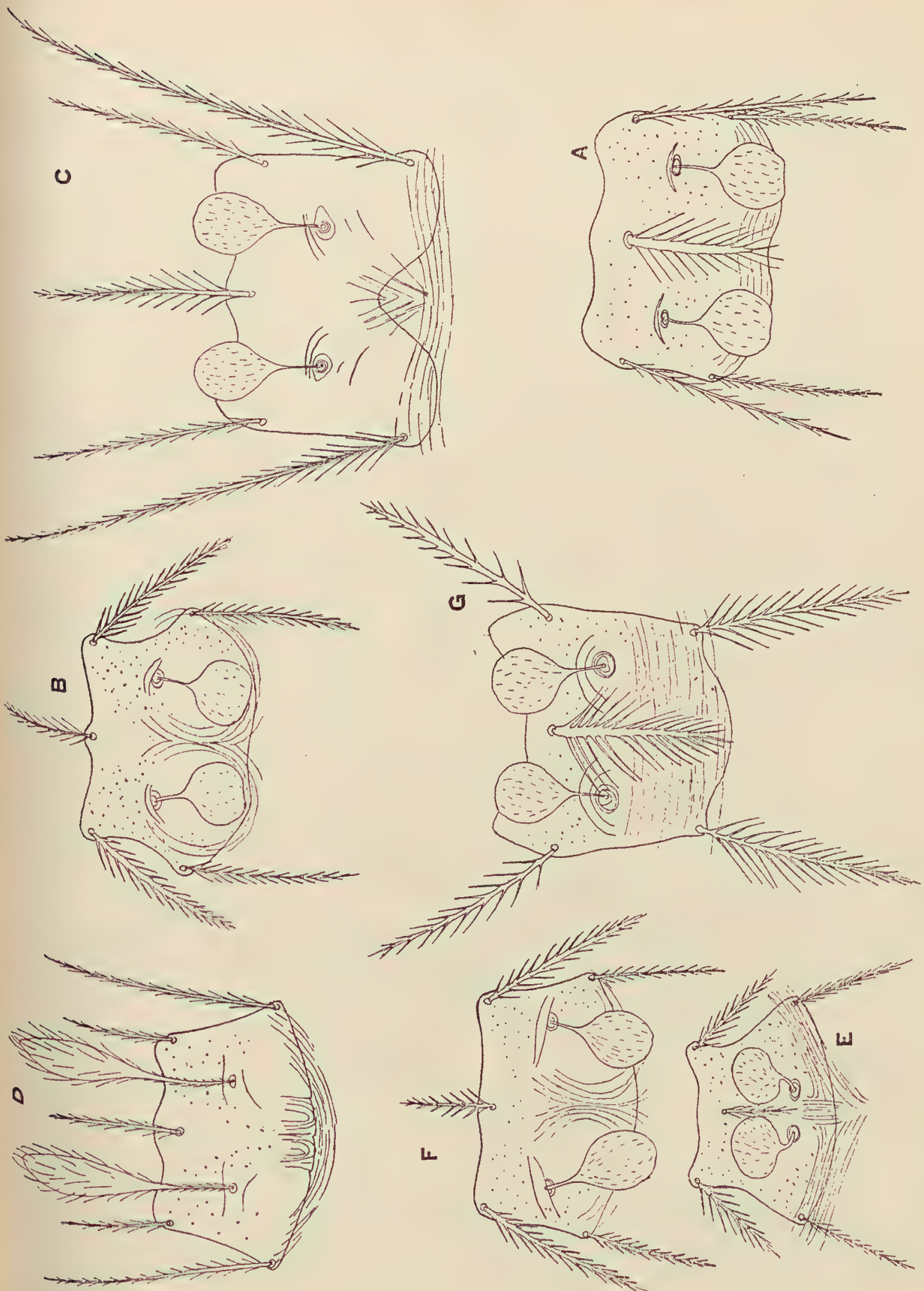

PLATE 75.

PLATE 76.

A–C. *Gahrliepia* (*Walchia*) *morobensis* (Gunther, 1939). A, scutum (× 500); B, palp; C, tip of chelicera.

D–F. *Gahrliepia* (*Walchia*) *rustica* Gater, 1932. D, scutum (× 500); E, palp; F, tip of chelicera.

G–I. *Gahrliepia* (*Walchia*) *turmalis* Gater, 1932. G, scutum (× 500); H, palp; I, tip of chelicera.

J–L. *Gahrliepia* (*Walchia*) *lewthwaitei* Gater, 1932. J, scutum (× 500); K, palp; L, coxa of leg III.

M–P. *Gahrliepia* (*Walchia*) *disparunguis* (Ouds., 1929). M, scutum (× 500); N, palp; O, tip of chelicera; P, coxa of leg III.

Q–T. *Gahrliepia* (*Walchia*) *ewingi* Fuller 1951 for *glabrum* Walch 1927, preoc. Q, scutum (× 500); R, palp; S, tip of chelicera; T, coxa of leg III.

U–X. *Gahrliepia* (*Walchia*) *enode* (Gater, 1932). U, scutum (× 500); V, palp; W, tip of chelicera; X, coxa of leg III.

PLATE 76.

PLATE 77.

A. *Gahrliepia* (*Walchia*) *rioi* Gunther, 1940. Scutum (× 500).

B–F. *Gahrliepia* (*Schöngastiella*) *ligula* (Radford, 1946). B, dorsum; C, venter; D, scutum (× 500); E, palp; F, tip of chelicera.

G–L. *Gahrliepia* (*Schöngastiella*) *ceylonica* sp. n. G, dorsum; H, venter; I, scutum (× 500); J, palp; K, tip of chelicera; L, coxa of leg III.

PLATE 77.

PLATE 78.

A. *Gahrliepia* (*Schöngastiella*) *brevis* (Radford, 1946). Scutum (× 500).

B. *Gahrliepia* (*Schöngastiella*) *bengalensis* (Hirst, 1915). Scutum (× 500).

C. *Gahrliepia* (*Schöngastiella*) *punctata* (Radford, 1946). Scutum (× 500).

D–G. *Gahrliepia* (*Schöngastiella*) *kumaonensis* sp. n. D, scutum (× 500); E, palp; F, tip of chelicera; G, coxa of leg III.

H–J. *Gahrliepia* (*Gateria*) *saduski* sp. n. H, scutum (× 500), I, palp; J, tip of chelicera.

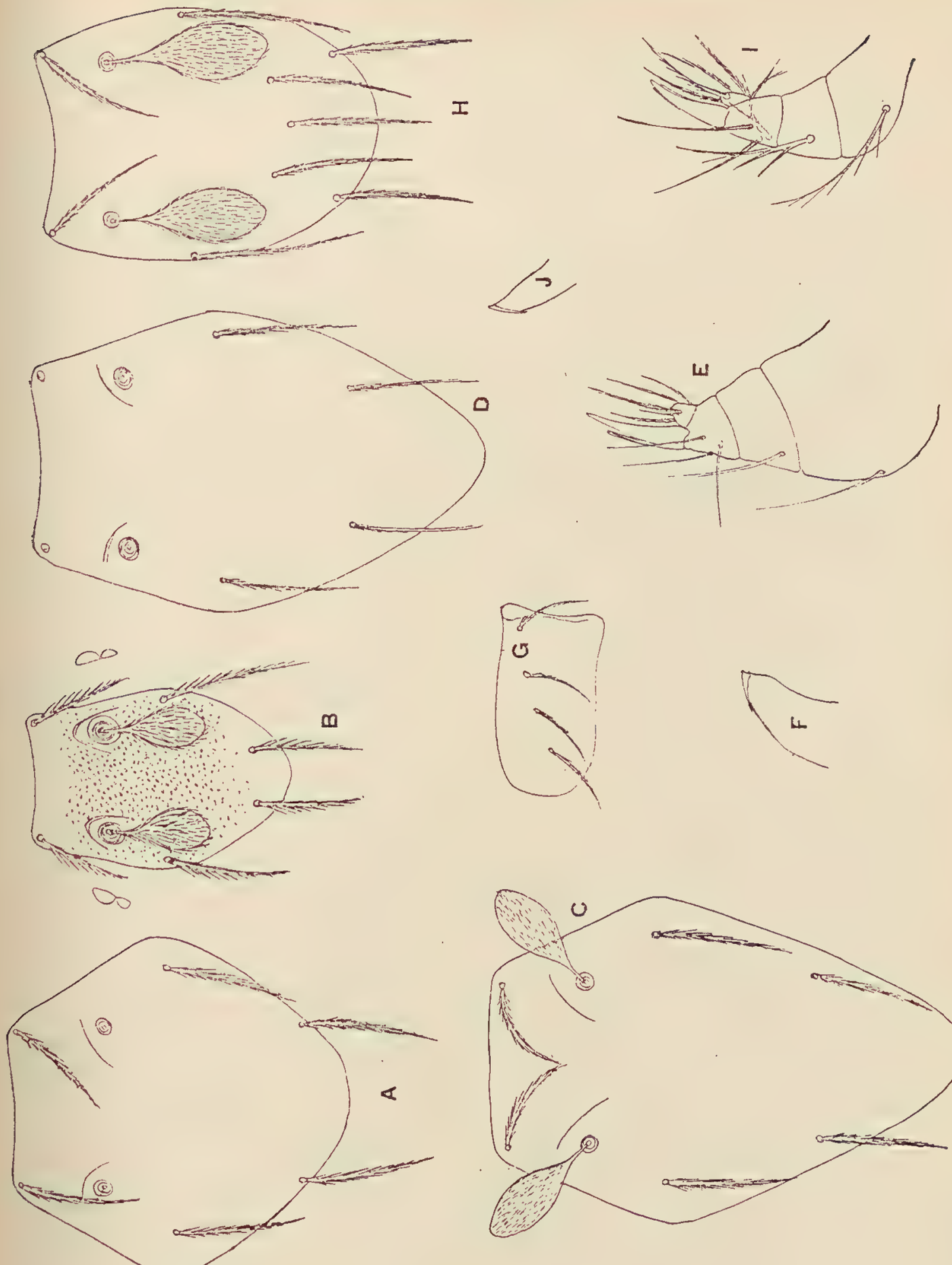

PLATE 78.

PLATE 79.

A–D. *Gahrliepia* (*Gahrliepia*) *insigne* sp. n. A, venter; B, dorsum; C, scutum (× 500); D, palp.

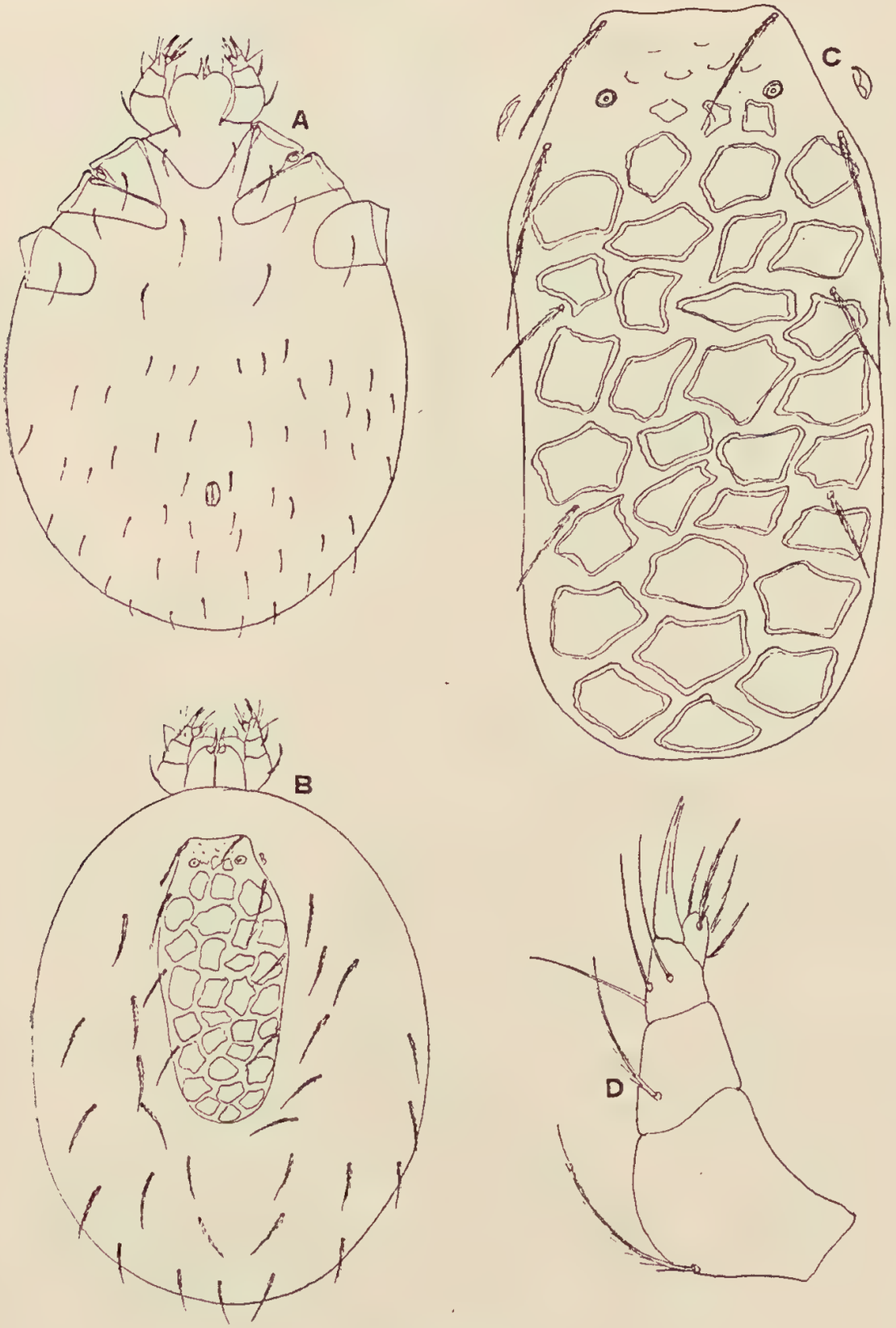

PLATE 79.

PLATE 80.

A–D. *Gahrliepia* (*Gahrliepia*) *decora* sp. n. A, dorsum; B, venter; C, scutum (× 500); D, palp.

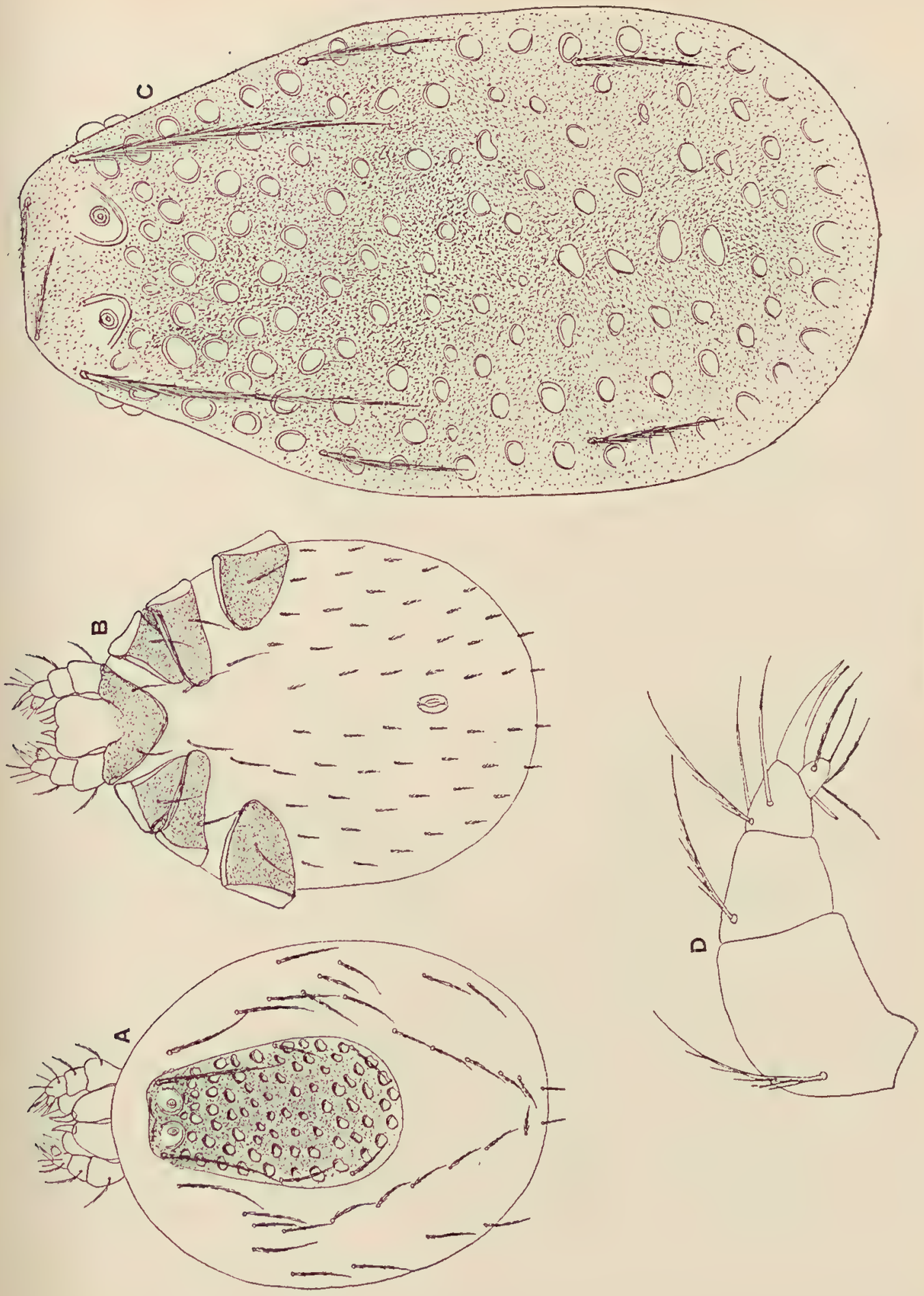

PLATE 80.

PLATE 81.

A–D. *Gahrliepia* (*Gahrliepia*) *ornata* sp. n. A, dorsum; B, venter; C, scutum (H× 500); D, palp.

PLATE 81.

PLATE 82.

A. *Gahrliepia* (*Gahrliepia*) *cetrata* Gater, 1932. Scutum (× 500).

B–D. *Gahrliepia* (*Gateria*) *hirsuta* (Radford, 1946). B, scutum (× 500); C, palp; D, tip of chelicera.

F. *Gahrliepia* (*Gateria*) *lancearia* (Radford, 1946). Scutum (× 500).

E. *Gahrliepia* (*Gateria*) *longipili* (Radford, 1946). Scutum (× 500).

G. *Gahrliepia* (*Gateria*) *crocidura* (Radford, 1946). Scutum (× 500).

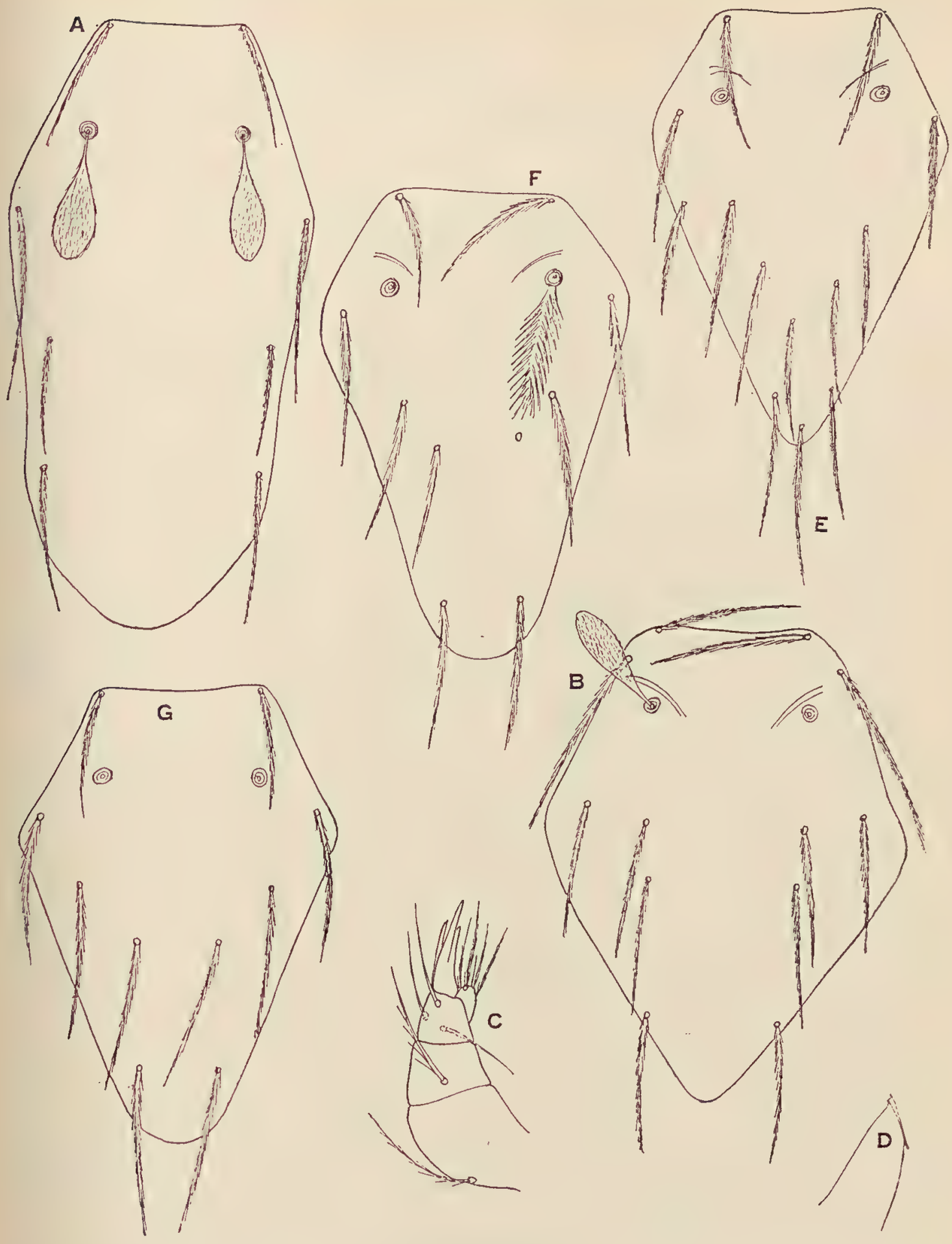

PLATE 82.

PLATE 83.

A–C. *Gahrliepia* (*Gateria*) *rutila* Gater, 1932. A, scutum (× 500); D, palp; C, tip of chelicera.

D. *Gahrliepia* (*Gateria*) *ciliata* Gater, 1932. Scutum (× 500).

E. *Gahrliepia* (*Gateria*) *spinulosa* (Radford, 1946). Scutum (× 500).

F–H. *Gahrliepia* (*Gateria*) *fletcheri* Gater, 1932. F, scutum (× 500); G, palp; H, tip of chelicera.

I. *Gahrliepia* (*Gateria*) *romeri* sp. n. Scutum (× 500).

PLATE 83.

PLATE 84.

A–F. *Tragardhula nilotica* (Ouds. 1904). Adult: A, crista, epistome and eyes; B, palpal tibia and tarsus in inner view; C, palpal tibia and tarsus in outer view; D, coxae I and II showing pseudosternum; E, front tarsus and metatarsus; F, posterior dorsal seta.

G–N. *Tragardhula acuscutellaris* (Walch, 1922). Adult: G, crista, epistome and left eye; H, chelicera; I, palpal tibia and tarsus in inner view; J, ditto, in outer view; K, coxae I and II with pseudosternum; L, front tibia and tarsus; M, posterior dorsal seta; N, male genitalia.

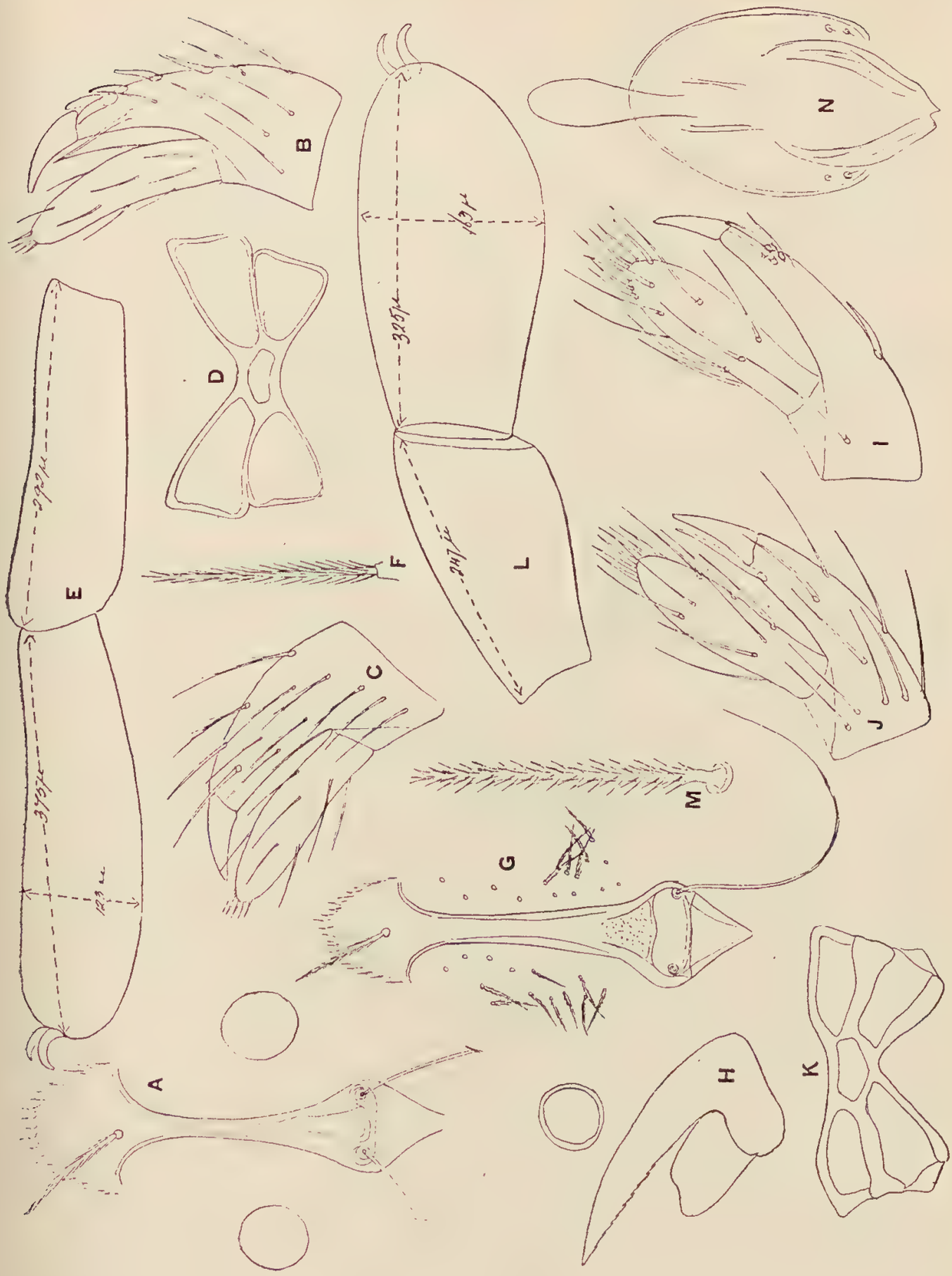

PLATE 84.

PLATE 85.

A–E. *Tragardhula allcei* (Ewing, 1926). Adult: A, crista, epistome and eyes; B, palpal tibia and tarsus, inner view; C, coxae I and II with pseudosternum; D, front tarsus and metatarsus; E, posterior dorsal seta.

F–H. *Tragardhula attenuata* (Michener, 1946). Adult (after Michener): F, palpal tibia and tarsus, inner view; G, front tibia and tarsus; H, posterior dorsal seta.

I–N. *Tragardhula velascoi* (Boshell and Kerr, 1942). Adult: I, crista and epistome; J, palpal tibia and tarsus, inner view; K, right coxae I and II with pseudosternum; L, front tarsus; M, front metatarsus; N, posterior dorsal seta.

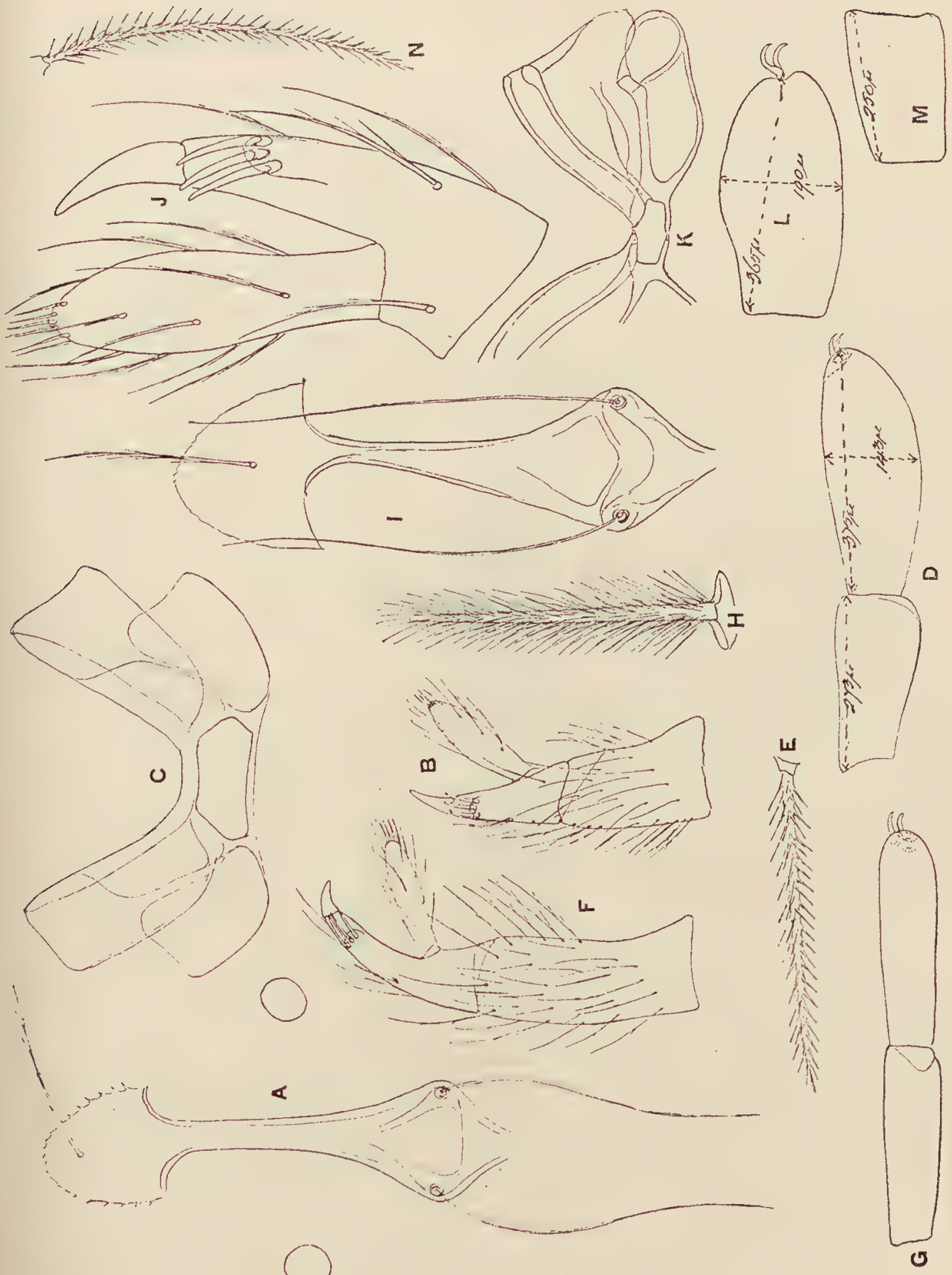

PLATE 85.

PLATE 86.

A–E. *Ipotrombicula elegans* (Womersley, 1942). Adult: A, crista, epistome and eyes; B, palpal tibia and tarsus, inner view; C, coxae I and II; D, front tarsus and metatarsus; E, posterior dorsal seta.

F–H. *Speotrombicula trifurca* (Ewing, 1933). Adult, after Ewing: F, epistome; G, coxae I and II with pseudosternum; H, front tarsus and metatarsus.

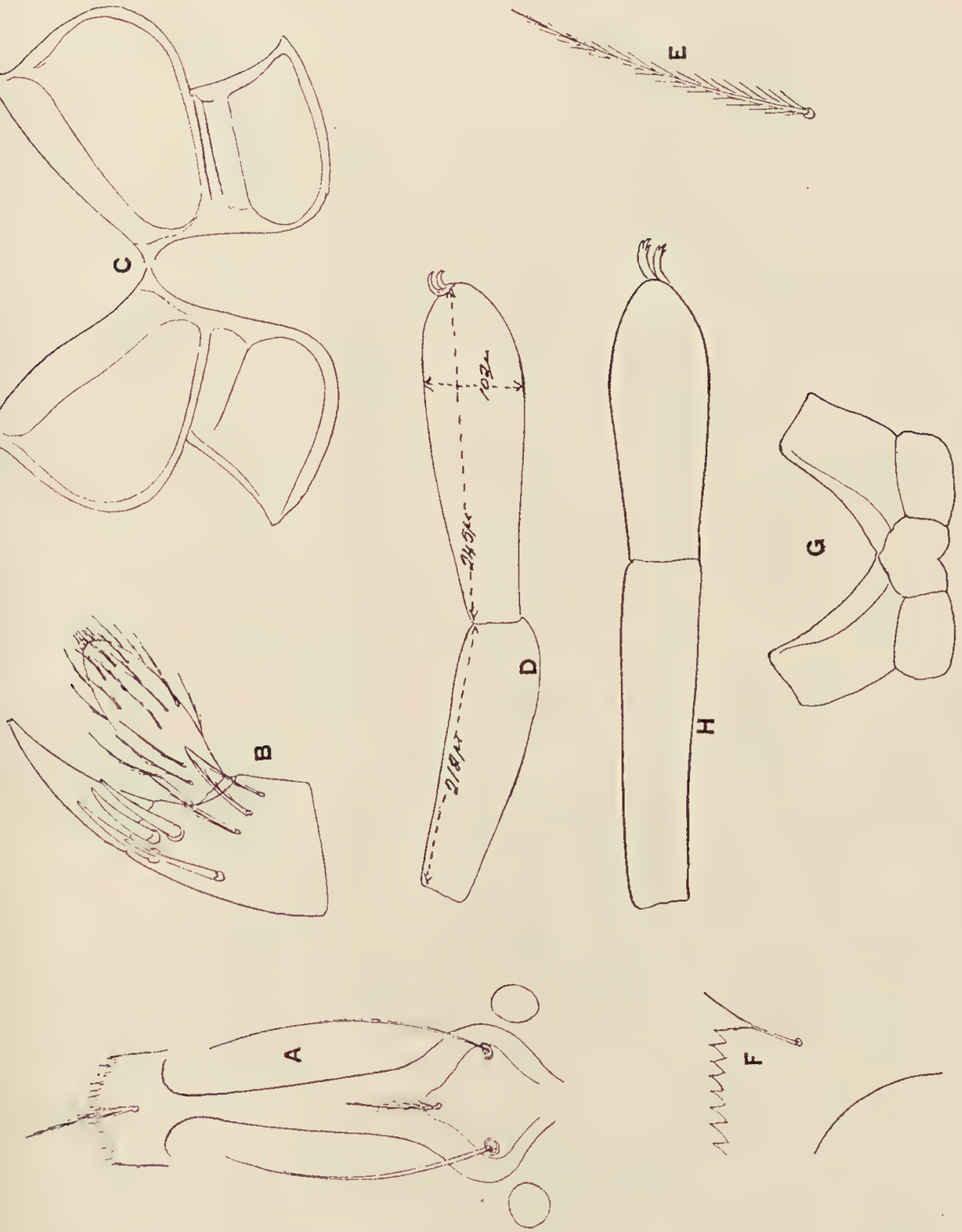

PLATE 86.

PLATE 87.

A–C. *Trombicula minor* Berl., 1905. Adult. A, sensillary area and eyes; B, palpal tibia; C, front tarus and metatarsus, after Berlese. A and B after Willmann.

D–G. *Trombicula frittsi* Wharton, 1945. Nymph: D, crista, epistome and eyes; E, palpal tibia and tarsus, inner view; F, front tibia and tarsus; G, posterior dorsal seta.

H–K. *Trombicula batatus* (Linn., 1758). Adult, after Michener: H, crista and eyes; I, palpal tibia and tarsus, inner view; J, front tarsus and metatarsus; K, posterior dorsal seta.

L–N. *Trombicula helleri* (Ouds., 1911). Adult, after Michener; L, palpal tibia and tarsus, inner view; M, front tibia and tarsus; N, posterior dorsal seta.

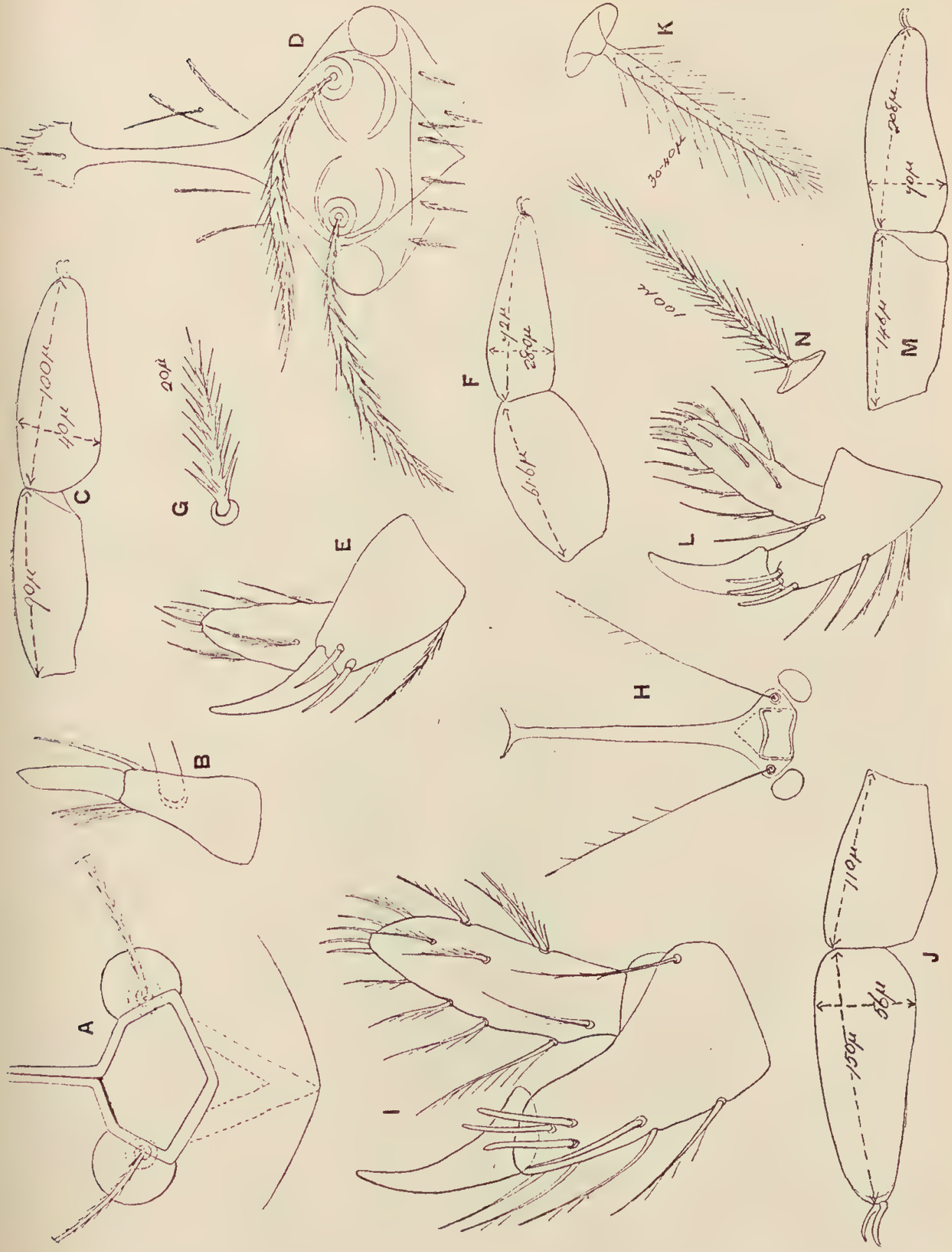
A
B
C
100μ
40μ
70μ
D
E
G
20μ
F
28×19μ
H
I
K
30×10μ
L
N
100μ
M
140μ
40μ
28×8μ
J
110μ
150μ
36μ

PLATE 87.

PLATE 88.

A–F. *Trombicula alfreddugesii* (Ouds., 1911). Adult: A, crista, epistome and eyes; B, palpal tibia and tarsus, inner view; C, coxae I and II with pseudosternum; D, front tarsus and metatarsus; E, posterior dorsal seta; F, male genitalia.

G–K. *Trombicula splendens* Ewing, 1913. Adult: G, crista, epistome and eyes; H, palpal tibia and tarsus, inner view; I, pseudosternum; J, front tarsus and metatarsus; K, posterior dorsal seta.

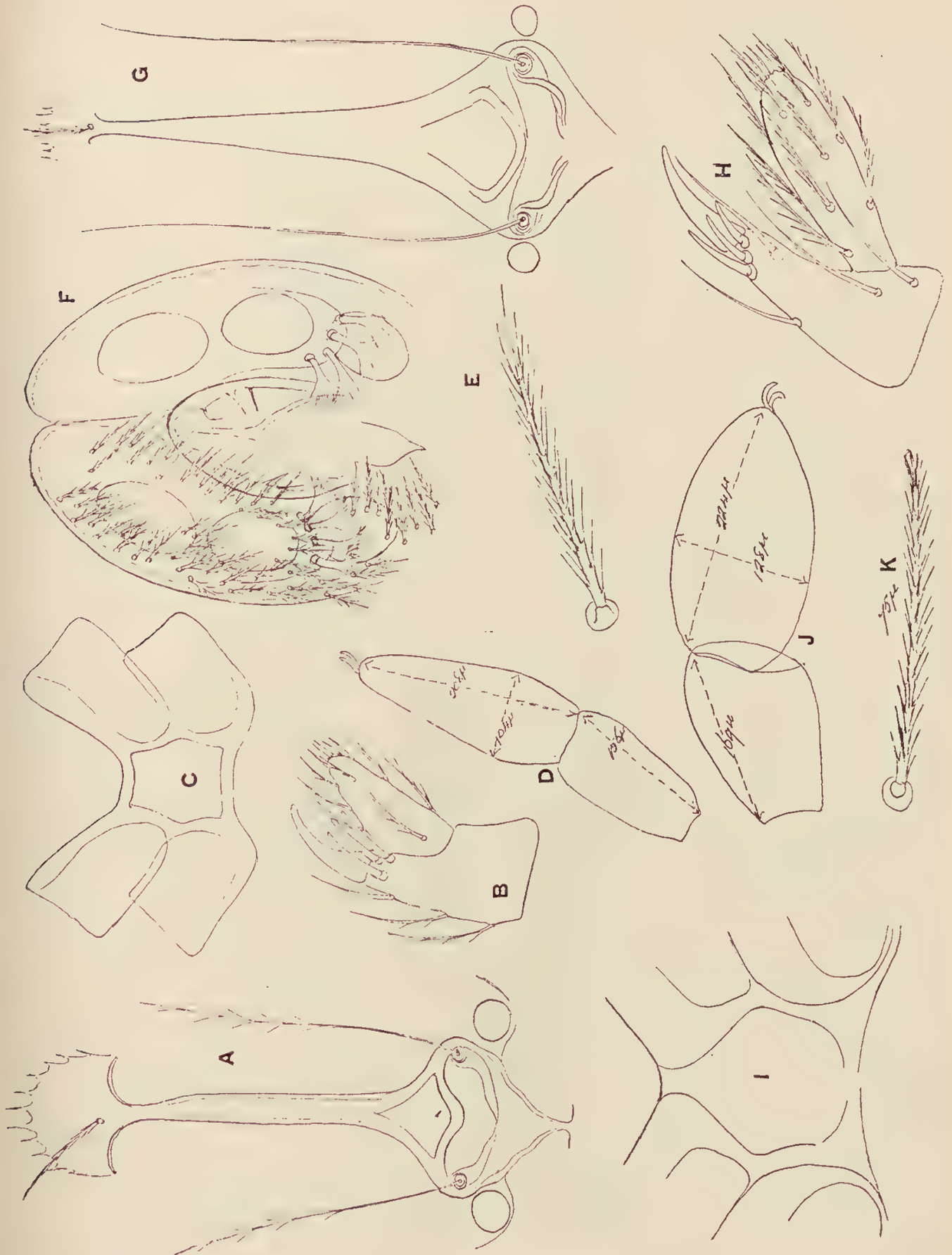

PLATE 88.

PLATE 89.

A–D. *Trombicula jacoti* nom. nov. Adult: A, crista, epistome and eyes; B, palpal tibia and tarsus, inner view; C, front tarsus and metatarsus; D, posterior dorsal seta.

E–I. *Trombicula wichmanni* (Ouds., 1905). Adult: E, crista, epistome and eyes; F, palpal tibia and tarsus; G, coxae I and II with pseudosternum; H, front tarsus and metatarsus; I, posterior dorsal seta.

J–O. *Trombicula samboni* Womersley, 1939. Adult: J, crista, epistome and eyes; K, palpal tibia and tarsus, inner view; L, ditto, outer view; M, coxae I and II with pseudosternum; N, front tarsus and metatarsus; O, posterior dorsal seta.

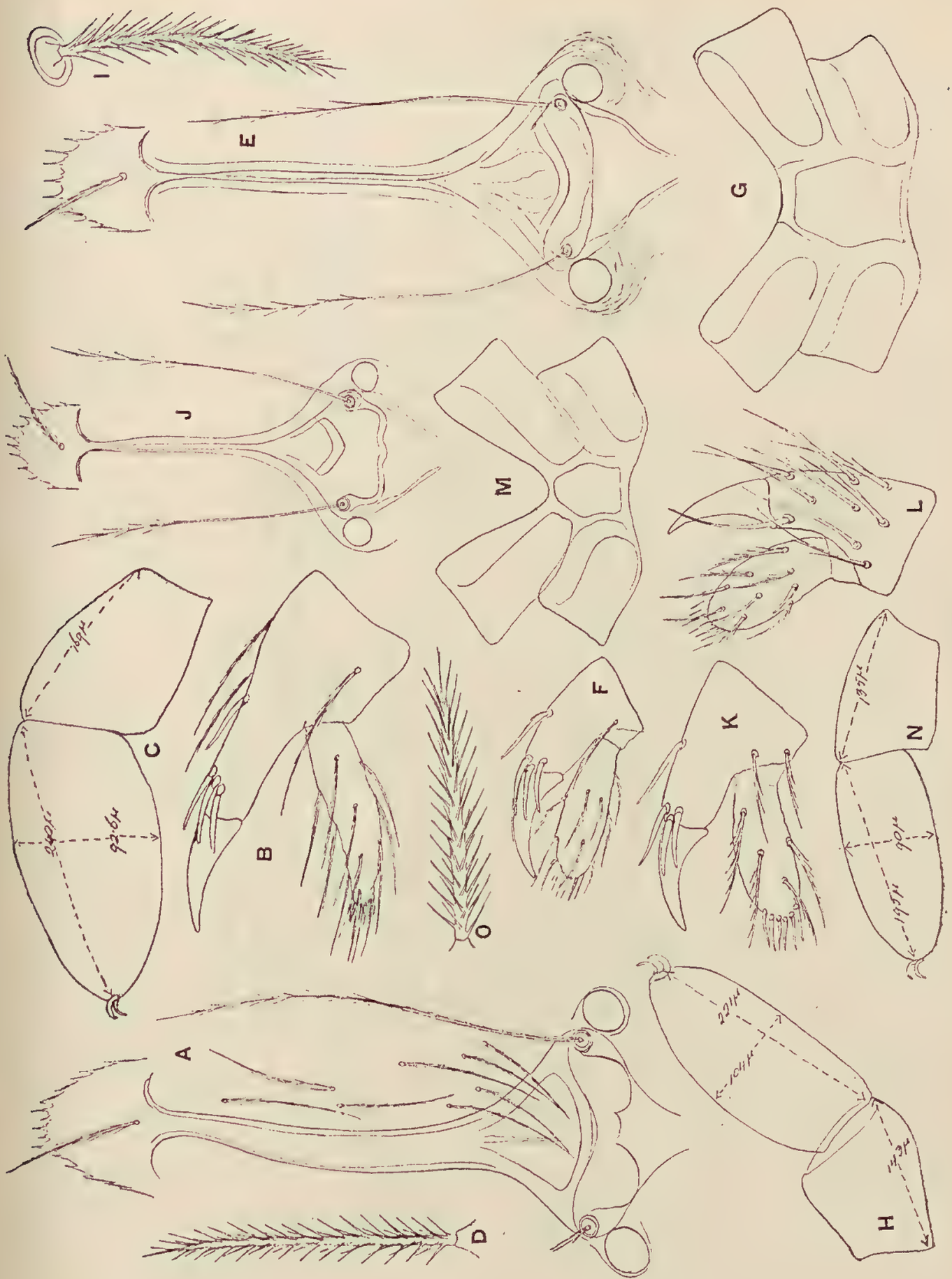

PLATE 89.

PLATE 90.

A–G. *Trombicula* (*Leptotrombidium*) *deliensis* (Walch, 1922). Adult: A, crista and epistome; B, palpal tibia and tarsus, inner view; C, ditto, outer view; D, coxae I and II and pseudosternum formed of precoxal plates of leg I; E, front tarsus and metatarsus; F, posterior dorsal seta; G, male genitalia.

H–M. *Trombicula* (*Leptotrombidium*) *akamushi* (Brumpt, 1910). Adult: H, crista and epistome; I, palpal tibia and tarsus, inner view; J, ditto, outer view; K, coxae I and II showing precoxal plates; L, front tarsus and metatarsus; M, posterior dorsal seta.

N–S. *Trombicula* (*Leptotrombidium*) *pallida* (Nagayo *et al.*, 1919). Adult: N, crista and epistome; O, palpal tibia and tarsus, inner view; P, ditto, outer view; Q, coxae I and II with precoxal plates; R, front tarsus and metatarsus; S, posterior dorsal seta.

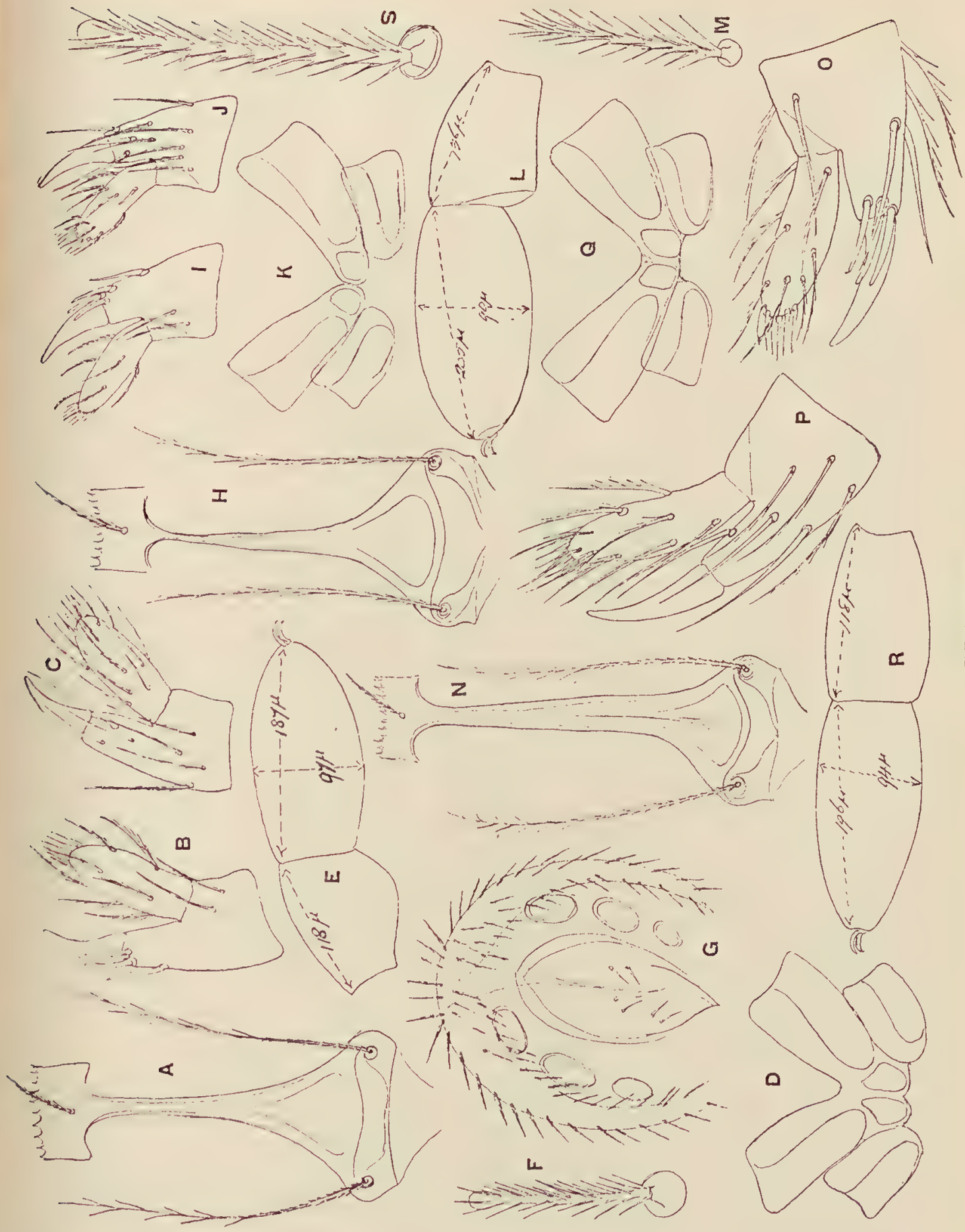

PLATE 90.

PLATE 91.

A–G. *Trombicula* (*Leptotrombidium*) *myzantha* sp. n. Nymph: A, crista and epistome; B, palpal tibia and tarsus, inner view; C, ditto, outer view; D, coxae I and II with precoxal plates; E, front tarsus and metatarsus; F, anterior dorsal seta; G, posterior dorsal seta.

H–L. *Trombicula* (*Leptotrombidium*) *burmensis* (Ewing, 1945). Nymph: H, crista; I, palpal tibia and tarsus, inner view; J, coxae I and II with precoxal plates forming pseudosternum; K, front tarsus and metatarsus; L, posterior dorsal seta.

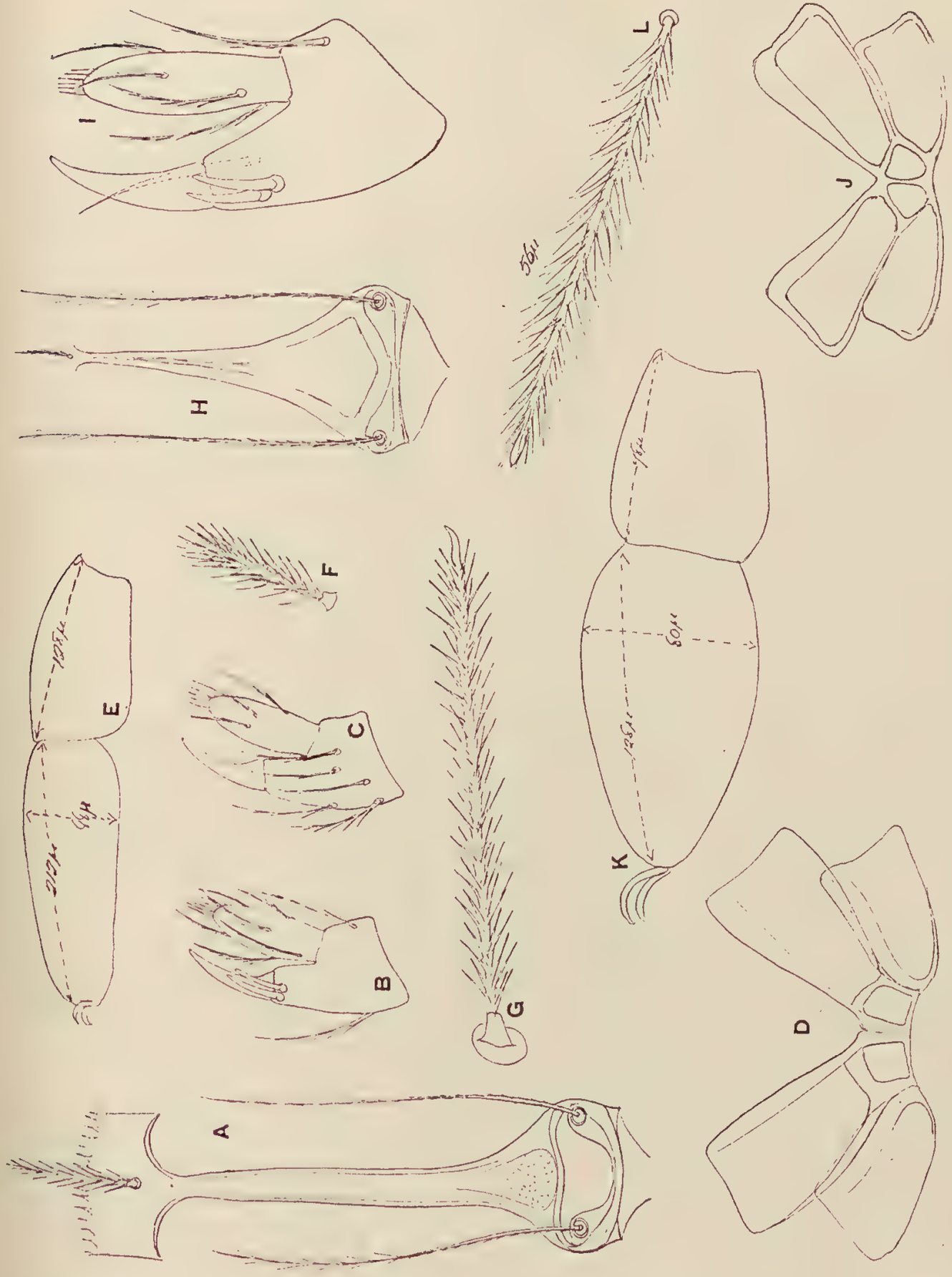

PLATE 91.

PLATE 92.

A–E. *Trombicula* (*Leptotrombidium*) *longiseta* sp. n. Nymph: A, crista; B, palpal tibia and tarsus, inner view; C, coxae I and II with precoxal plates forming pseudosternum; D, front tarsus and metatarsus; E, posterior dorsal seta.

F–J. *Trombicula* (*Leptotrombidium*) *fulleri* (Ewing 1945). Nymph: F, crista and epistome; G, palpal tibia and tarsus, inner view; H, coxae I and II with precoxal plates forming pseudosternum; I, front tarsus and metatarsus; J, posterior dorsal seta.

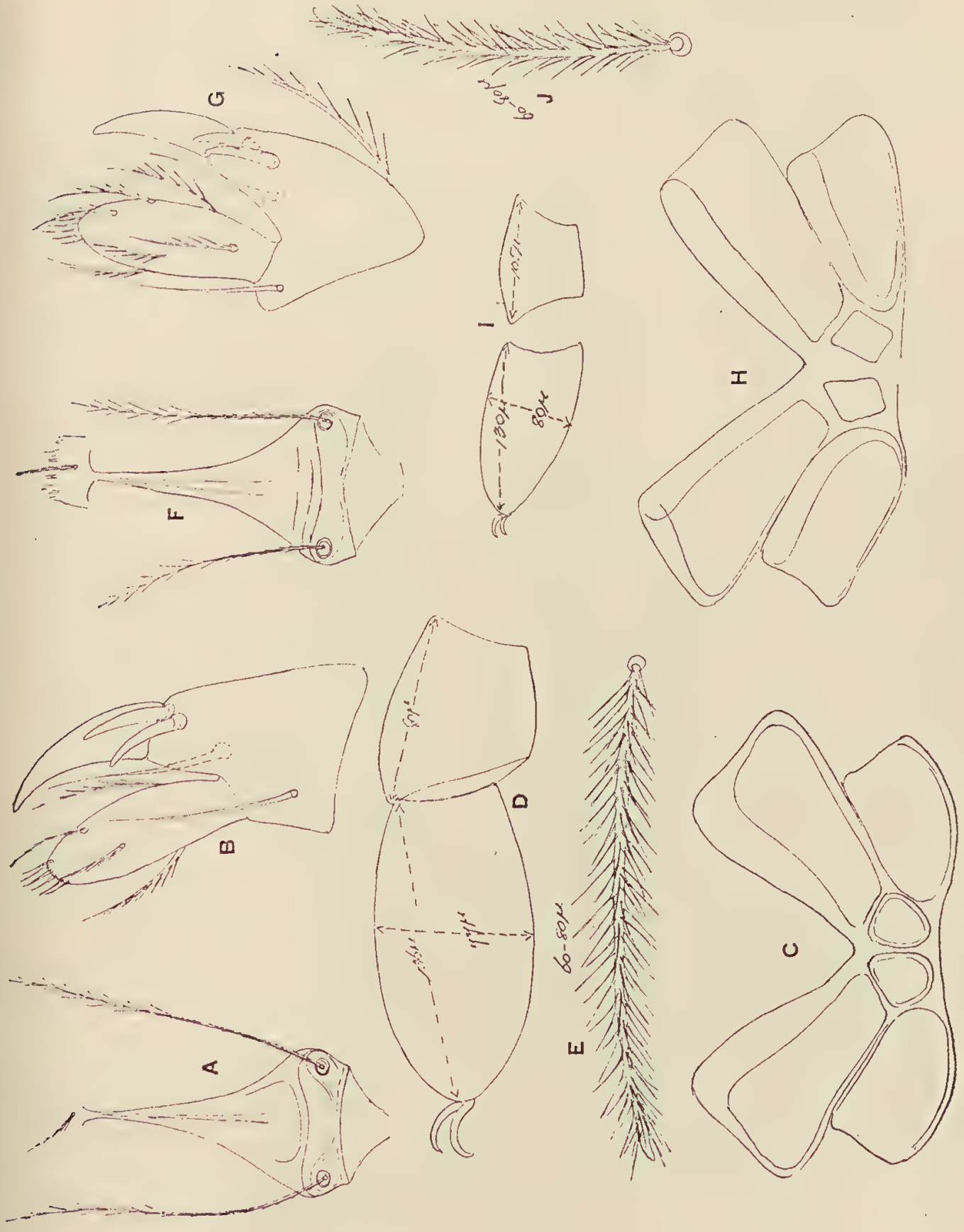

PLATE 92.

PLATE 93.

A–F. *Trombicula* (*Neotrombicula*) *scincoides* (Womersley, 1944). Adult: A, crista and epistome; B, palpal tibia and tarsus, inner view; C, coxae I and II with pseudosternum; D, front tarsus and metatarsus; E, posterior dorsal setae from above and from side; F, male genitalia.

G–L. *Trombicula* (*Neotrombicula*) *rara* (Walch, 1924). Nymph: G, crista and epistome; H, palpal tibia and tarsus, inner view; I, ditto, outer view; J, chelicera; K, front tarsus and metatarsus; L, posterior dorsal setae from above and from sides.

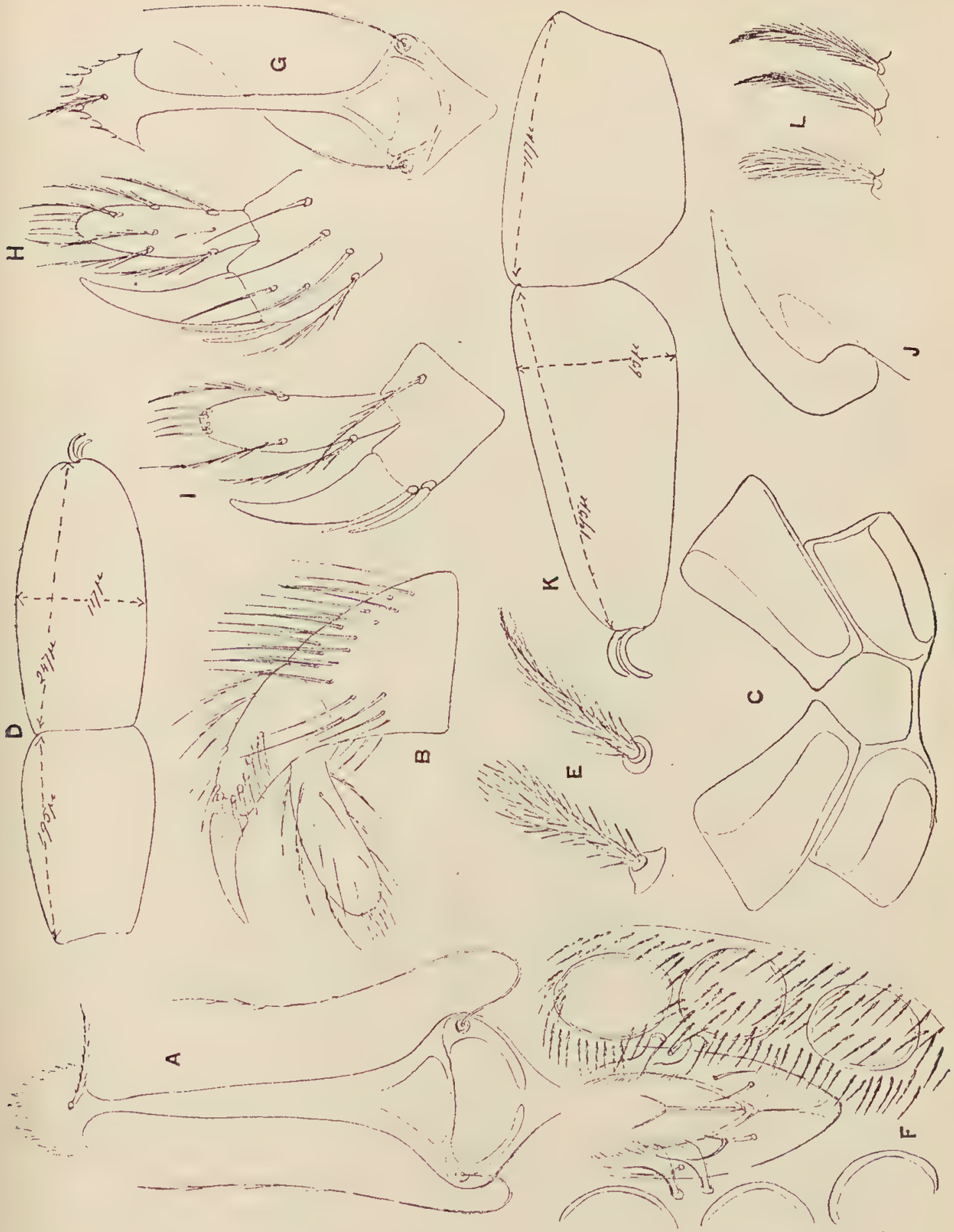

PLATE 93.

PLATE 94.

A–D. *Trombicula* (*Neotrombicula*) *hastata* (Gater, 1932). Nymph: A, crista; B, palpal tibia and tarsus, inner view; C, front tarsus and metatarsus; D, posterior dorsal seta.

E–K. *Trombicula* (*Neotrombicula*) *jayewickremei* sp. n. Nymph: E, crista and epistome; F, palpal tibia and tarsus, inner view; G, ditto, outer view; H, coxae I and II; I, front tarsus and metatarsus; J, anterior dorsal seta; K, posterior dorsal seta.

L–R. *Trombicula* (*Neotrombicula*) *canestrinii* (Buffa, 1899). Adult: L, crista and epistome; M, palpal tibia and tarsus, inner view; N, ditto, outer view; O, coxae I and II with pseudosternum; P, front tarsus and metatarsus; Q, posterior dorsal seta; R, tip of same, much enlarged.

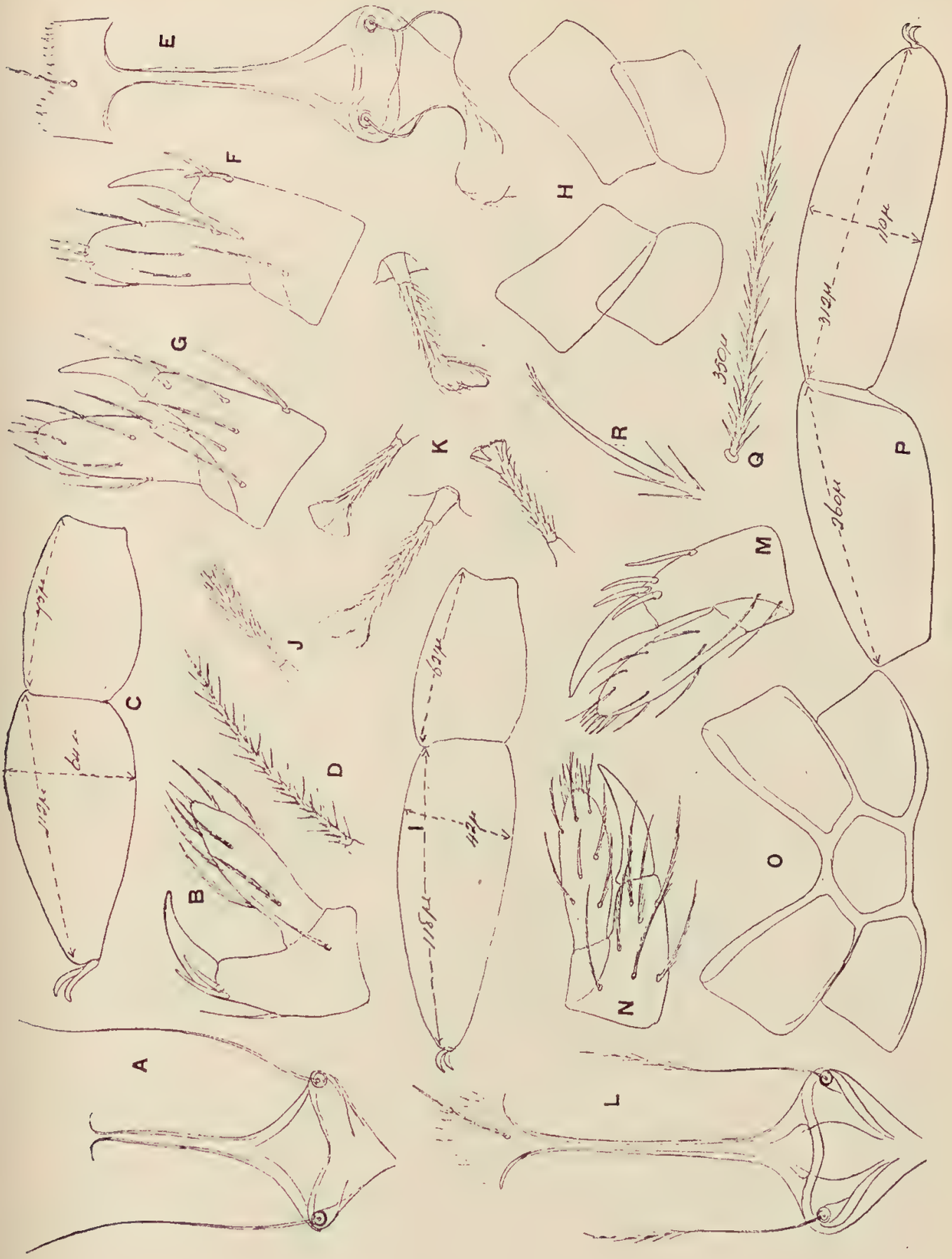

PLATE 94.

PLATE 95.

A–E. *Trombicula* (*Neotrombicula*) *clavicata* (Andre, 1937). Adult: A, crista and epistome; B, palpal genu, tibia and tarsus, inner view; C, coxae I and II with pseudosternum; D, front tarsus and metatarsus; E, posterior dorsal seta.

F–G. *Trombicula* (*Neotrombicula*) *cavernarum* (Ewing, 1933). Adult: F, sternum and coxae I and II; G, front tarsus and metatarsus; (re-drawn to scale from Ewing's entire ventral figure).

H–J. *Trombicula* (*Neotrombicula*) *formicarum* (Berl., 1910). Adult: H, front tarsus and metatarsus; I, palp, inner view; J, posterior dorsal seta (after Berlese).

K–L. *Trombicula* (*Neotrombicula*) *coarctata* (Berl., 1888). Adult: K, front tarsus and metatarsus; L, posterior dorsal setae (after Berlese).

M. *Trombicula* (*Neotrombicula*) *goldii* (Ouds., 1910). Adult: anterior and posterior dorsal setae (after Boshell and Kerr).

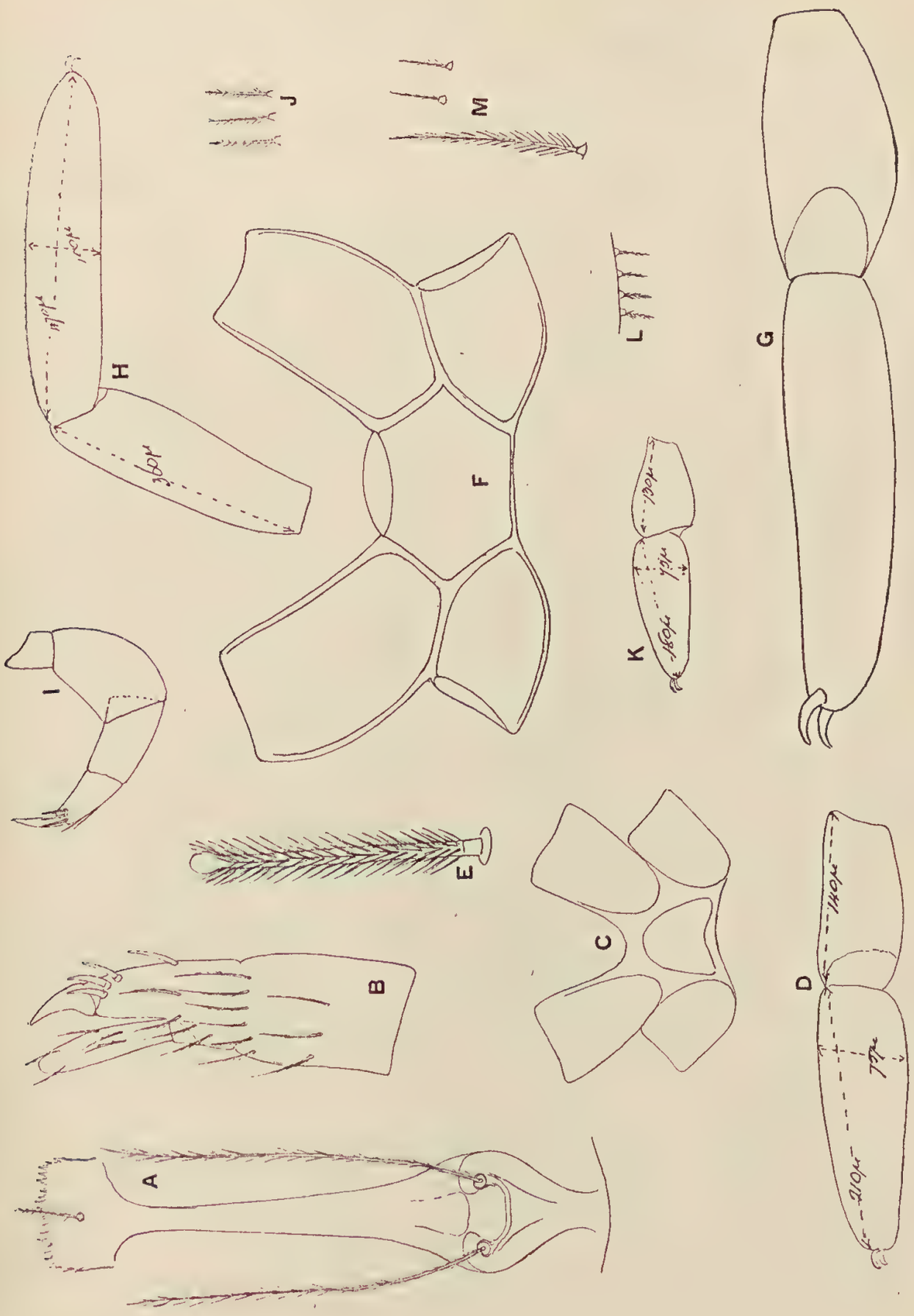

PLATE 95.

PLATE 96.

A–F. *Trombicula* (*Neotrombicula*) *camilla* (Wharton, 1938). Adult: A, crista and epistome; B, palpal tibia and tarsus, inner view; C, epistome of aberrant specimen with 2 setae; D, front tarsus and metatarsus; E, posterior dorsal seta; F, male genitalia (after Wharton).

G–L. *Trombicula* (*Neotrombicula*) *spicea* (Gater, 1932). Nymph: G, crista and epistome; H, palpal tibia and tarsus, inner view; I, ditto, outer view; J, coxae I and II; K, posterior dorsal setae; L, front tarsus and metatarsus.

M–Q. *Trombicula* (*Neotrombicula*) *fordi* sp. n. Lawrence. Nymph: M, crista and epistome; N, palpal tibia and tarsus, inner view; O, front tarsus and metatarsus; P, anterior dorsal seta; Q, posterior dorsal seta.

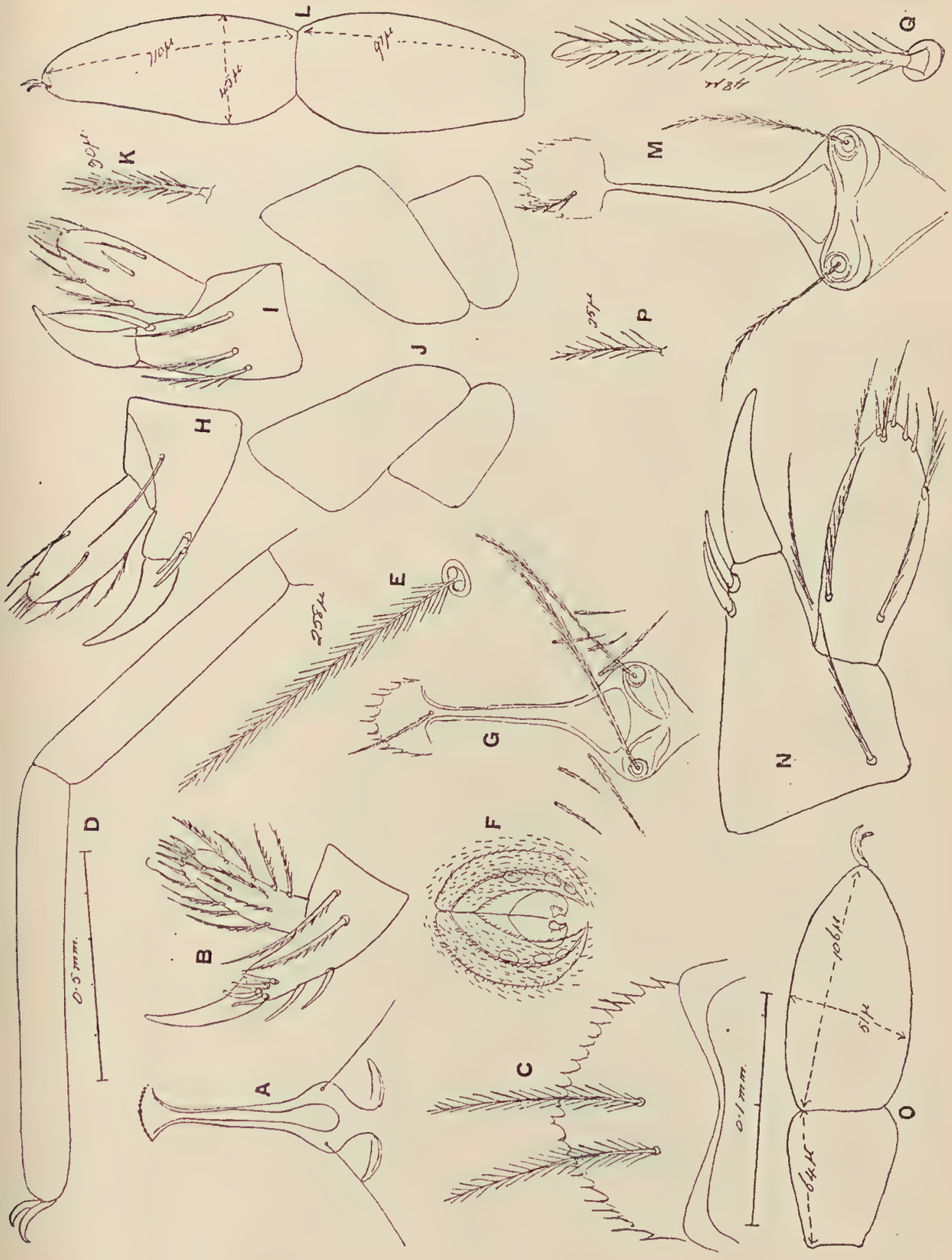

PLATE 96.

PLATE 97.

A–F. *Trombicula* (*Neotrombicula*) *sarcina* (Womersley, 1944). Nymph: A, crista and epistome; B, palpal tarsus and metatarsus, inner view; C, ditto, outer view; D, coxae I and II and pseudosternum; E, front tarsus and metatarsus; F, posterior dorsal seta.

G–J. *Trombicula* (*Neotrombicula*) *moesica* (Andre, 1932). Adult: G, crista and epistome; H, palpal tarsus and metatarsus, inner view; I, coxae I and II and pseudosternum; J, posterior dorsal seta.

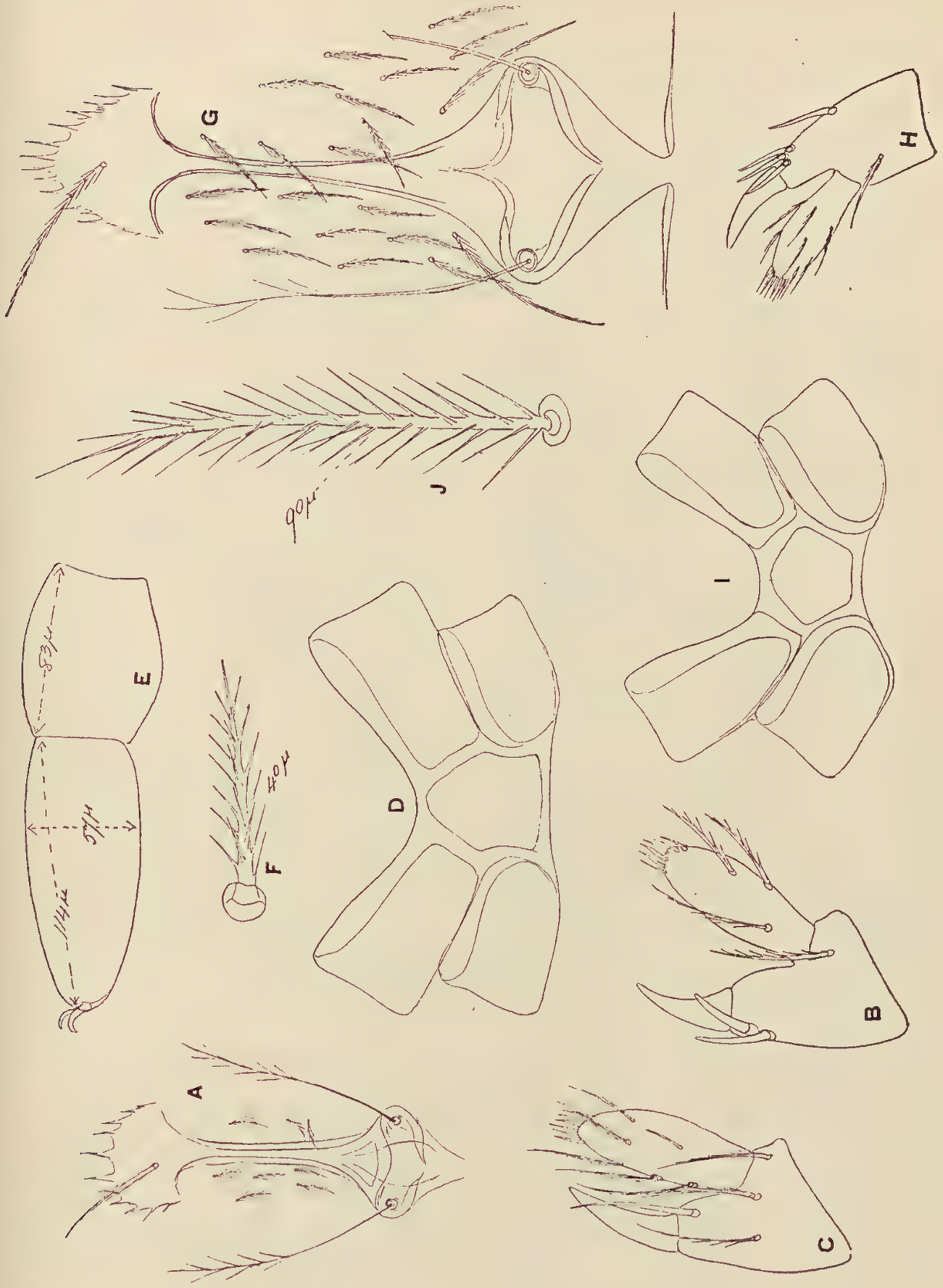

PLATE 97.

PLATE 98.

A–G. *Trombicula* (*Neotrombicula*) *autumnalis* (Shaw, 1790). Adult: A, crista and epistome; B, palpal tibia and tarsus, inner view; C, ditto, outer view; D, coxae I and II and pseudosternum; E, front tarsus and metatarsus; F, posterior dorsal seta; G, male genitalia.

H–M. *Trombicula* (*Neotrombicula*) *inopinatum* (Ouds., 1909). Nymph, after Oudemans: H, crista; I, palpal tibia and tarsus, inner view; J, ditto, outer view; K, mandible; L, front tarsus and metatarsus; M, dorsal setae.

N–O. *Trombicula* (*Neotrombicula*) sp. Cooreman *in litt.* Adult, after Cooreman; N, crista and epistome; O, anterior and posterior dorsal setae.

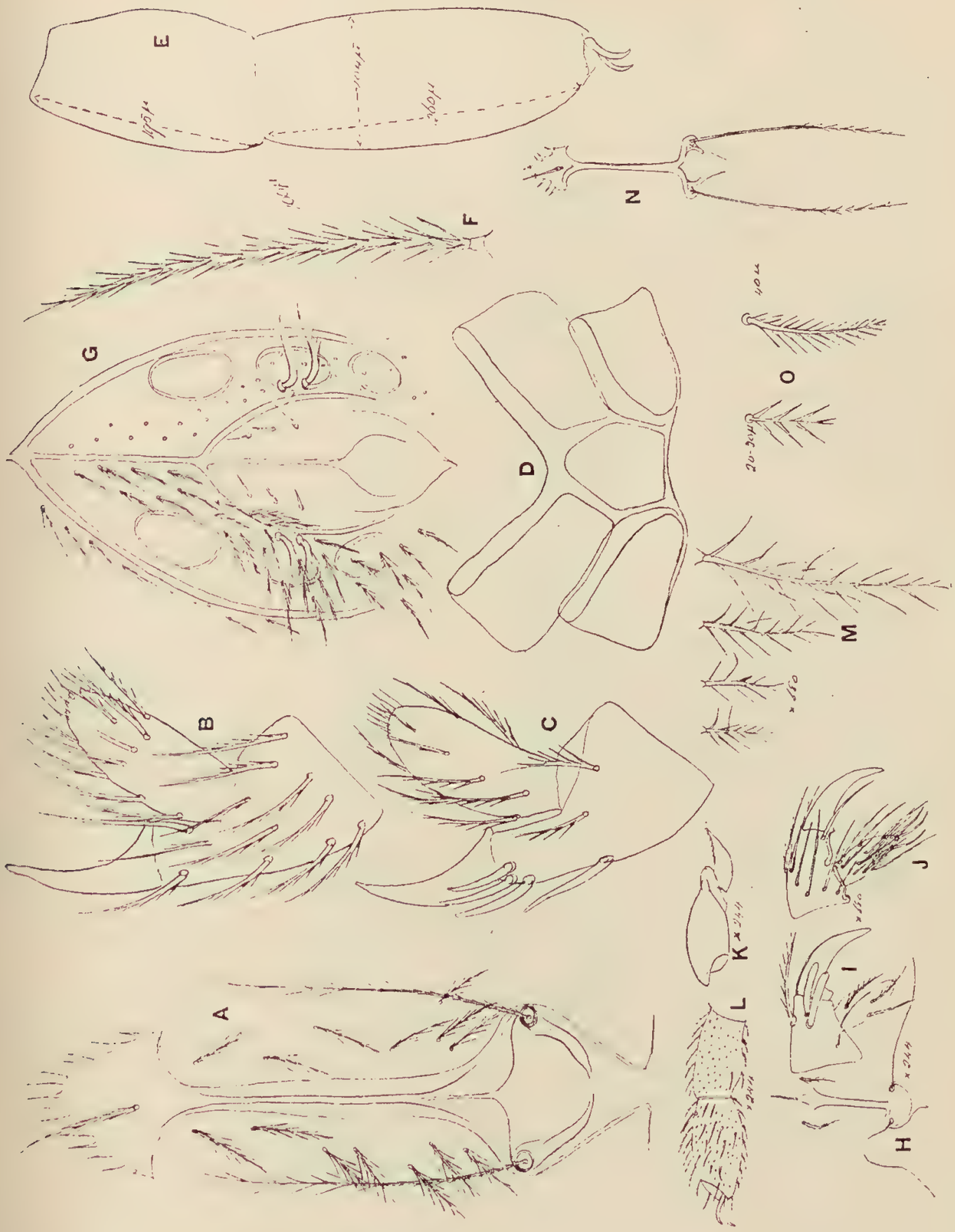

PLATE 98.

PLATE 99.

A–F. *Guntherana bipygalis* (Gunther, 1939). Nymph: A, crista and epistome; B, palpal tibia and tarsus, inner view; C, ditto, outer view; D, coxae I and II showing precoxal plates; E, front tarsus and metatarsus; F, posterior dorsal seta.

G–L. *Guntherana tindalei* (Wom., 1936). Adult: G, crista and epistome; H, palpal tibia and tarsus, inner view; I, ditto, outer view; J, coxae I and II showing precoxal plates; K, front tarsus and metatarsus; L, posterior dorsal seta.

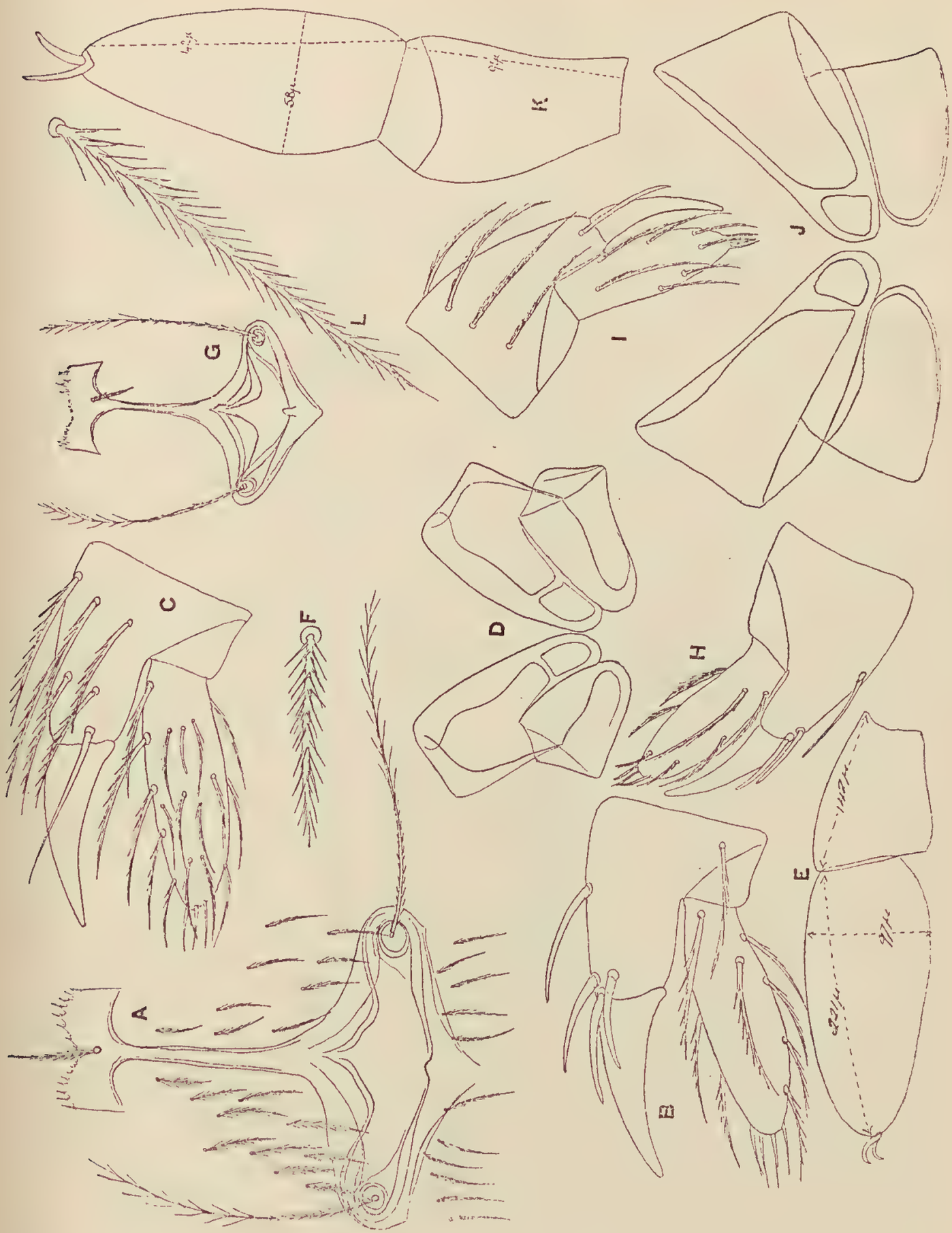

PLATE 99.

PLATE 100.

A–F. *Guntherana translucens* (Wom., 1944). Adult: A, crista and epistome; B, palpal tibia and tarsus, inner view; C, ditto, outer view; D, left coxae I and II; E, front tarsus and metatarsus; F, posterior dorsal seta.

G–K. *Schöngastia* (*Ascoschöngastia*) *indica* (Hirst, 1915). Adult: G, crista and epistome; H, palpal tibia and tarsus, inner view; I, front tarsus and metatarsus; J, posterior dorsal setae; K, male genitalia (after Wharton).

L–O. *Schöngastia algerica* (André, 1932). Adult: L, crista and epistome; M, coxae I and II and pseudosternum; N, front tarsus and metatarsus.

PLATE 100.

PLATE 101.

A–E. *Schöngastia* (*Ascoschöngastia*) *kohlsi* (Philip and Woodward, 1945). Nymph: A, crista and epistome; B, palpal tibia and tarsus, inner view; C, ditto, outer view; D, front tarsus and metatarsus; E, posterior dorsal seta.

F–L. *Schöngastia* (*Schöngastia*) *oudemansi* (Walch, 1922). Nymph: F, crista and epistome; G, palpal tibia and tarsus, inner view; H, ditto, outer view; I, coxae I and II and pseudosternum; J, front tarsus and metatarsus; K, posterior dorsal seta; L, anterior dorsal seta.

M–O. *Schöngastia* (*Schöngastia*) *schuffneri* (Walch, 1923). Nymph: M, crista; N, palpal tibia and tarsus, inner view; O, posterior dorsal seta (after Walch).

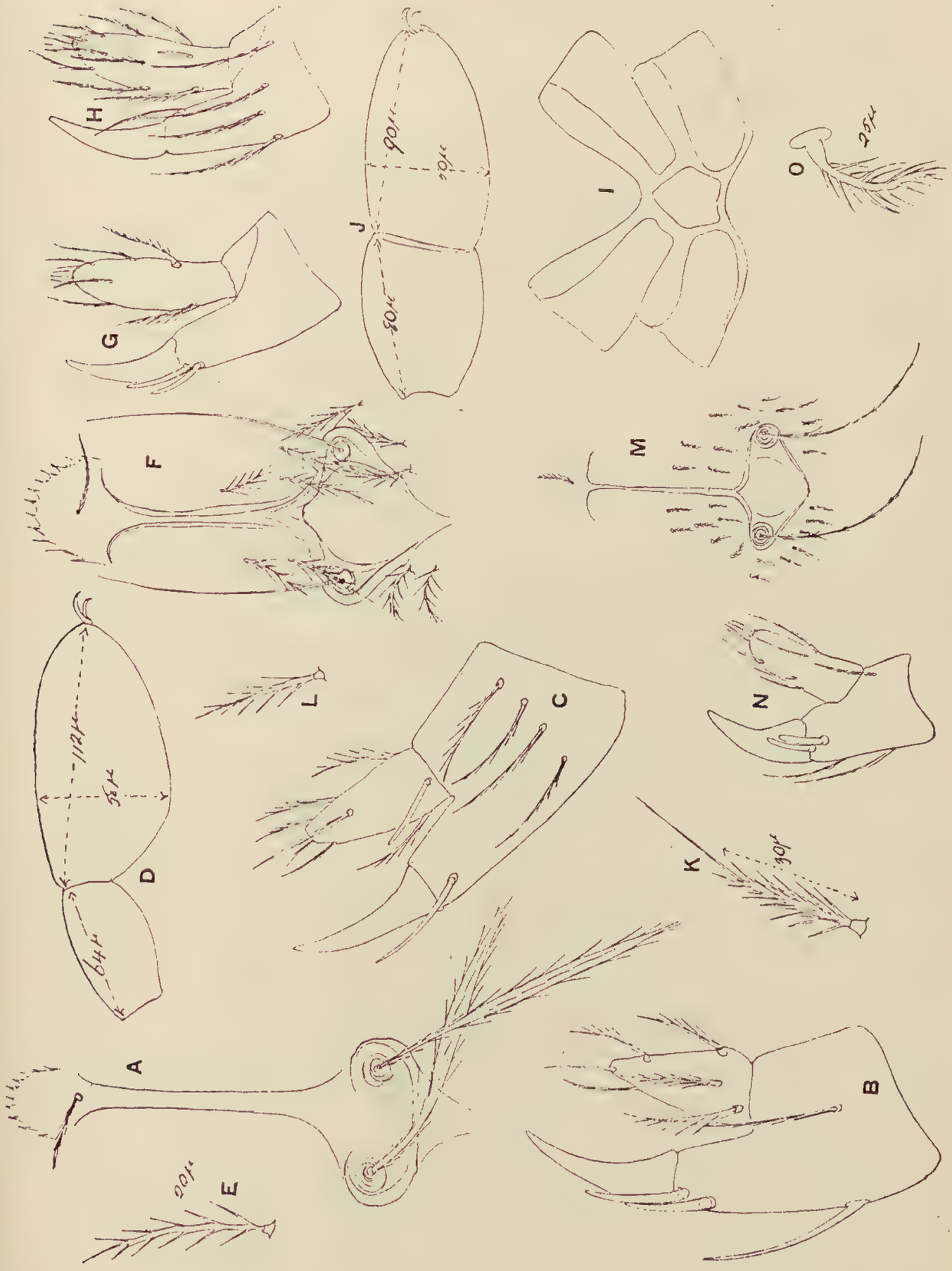

PLATE 101.

PLATE 102.

A–L. *Schöngastia* (*Schöngastia*) *maldiviensis* Radford, 1946. A–F Adult: A, crista and epistome; B, palpal tibia and tarsus, inner view; C, ditto, outer view; D, coxae I and II and pseudosternum; E, front tarsus and metatarsus; F, posterior dorsal seta.

G–L. Nymph: G, crista and epistome; H, palpal tibia and tarsus, inner view; I, ditto, outer view; J, coxae I and II and pseudosternum; K, front tarsus and metatarsus; L, posterior dorsal seta.

M–P. *Schöngastia* (*Ascoschöngastia*) *lanius* (Radford, 1946). Nymph: M, crista and epistome; N, palpal tarsus and tibia, inner view; O, front tarsus and metatarsus; P, posterior dorsal seta.

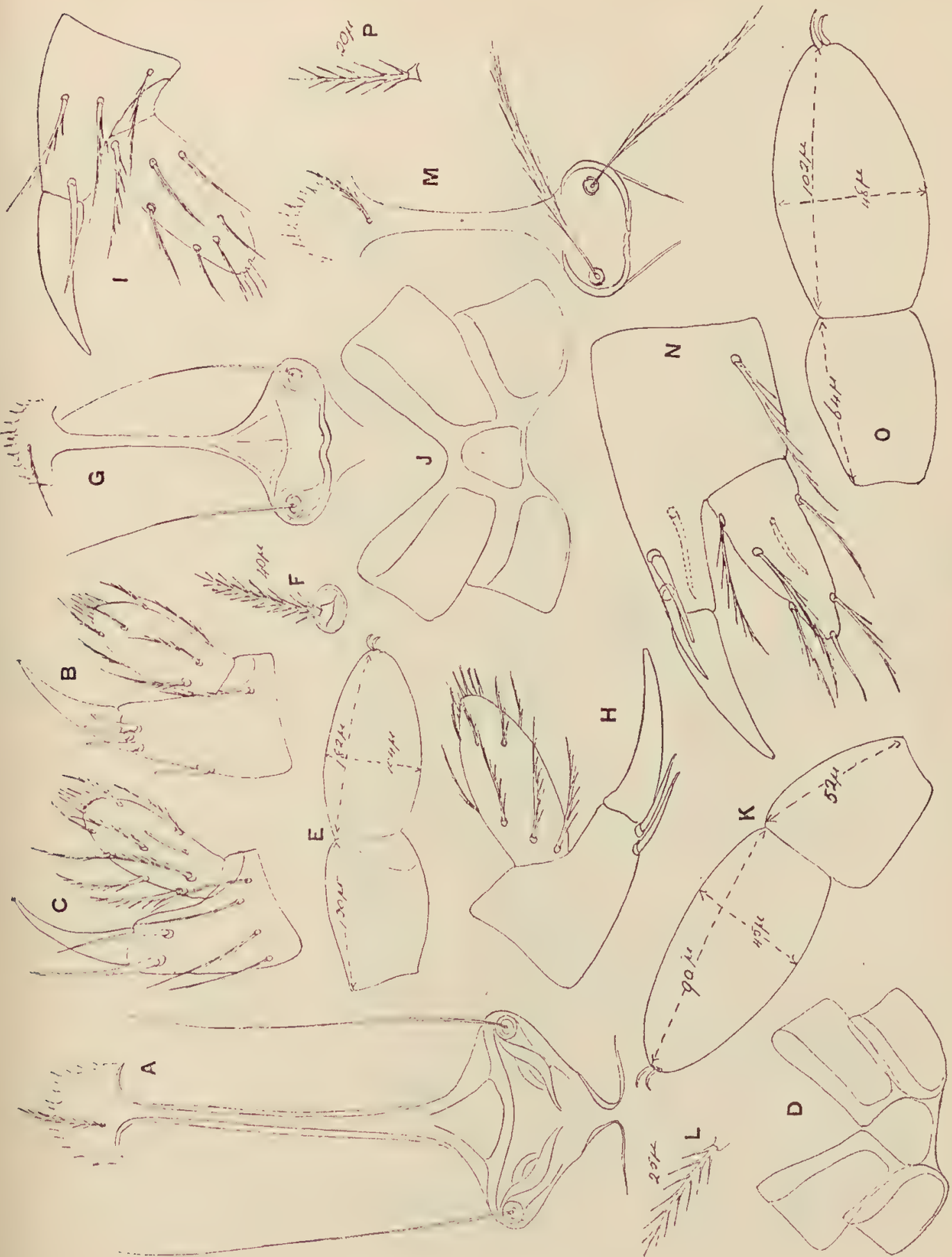

PLATE 102.

PLATE 103.

A–F. *Schöngastia* (*Ascoschöngastia*) *mutabilis* (Gater, 1932). Nymph: A, crista and epistome; B, palpal tibia and tarsus, inner view; C, ditto, outer view; D, front tarsus and metatarsus; E, anterior dorsal seta; F, posterior dorsal seta.

G–L. *Schöngastia* (*Ascoschöngastia*) *oculicola* sp. n. Nymph: G, crista; H, tip of crista with aberrant paired epistomal setae; I, palp; J, tip of hypostome; K, front tarsus and metatarsus; L, posterior dorsal seta.

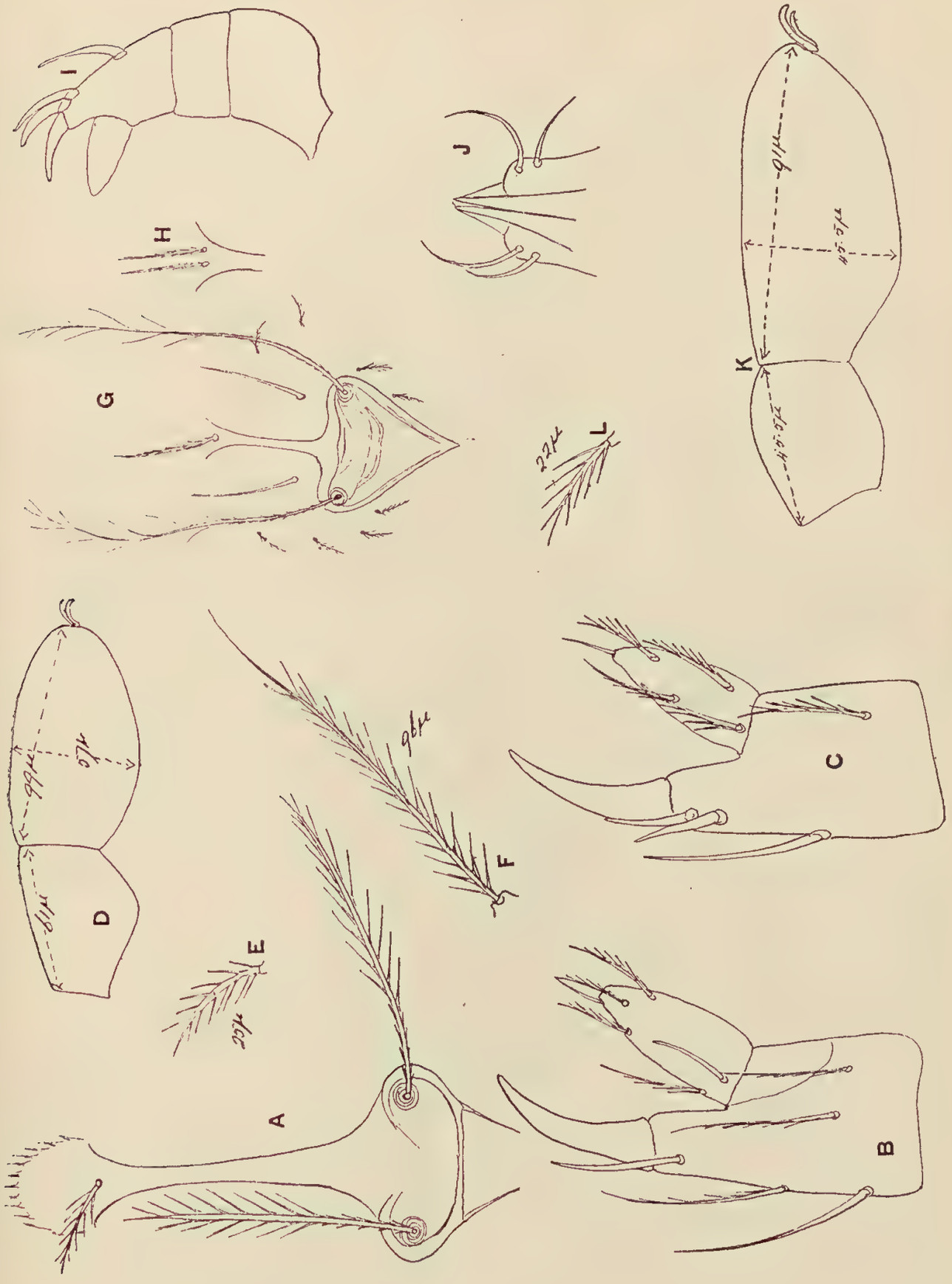

PLATE 103.

PLATE 104.

A–F. *Schöngastia westraliensis* (Wom., 1934). Adult: A, crista and epistome; B, palpal tibia and tarsus, inner view; C, ditto, outer view; D, coxae I and II; E, front tarsus and metatarsus; F, posterior dorsal seta.

G–J. *Schöngastia* (*Ascoschöngastia*) *malayensis* (Gater 1932). G, crista; H, palpal tibia and tarsus, inner view; I, front tarsus and metatarsus; J, posterior dorsal seta.

PLATE 104.

PLATE 105.

A–E. *Schöngastia* (*Schöngastia*) *vieta* (Gater, 1932). Nymph: A, crista and epistome; B, palpal tibia and tarsus, inner view; C, front tarsus and metatarsus; D, posterior dorsal seta; E, coxae I and II and pseudosternum.

F–I. *Schöngastia* (*Ascoschöngastia*) *audyi* sp. n. Nymph: F, crista and epistome; G, palpal tibia and tarsus, inner view; H, front tarsus and metatarsus; I, posterior dorsal seta.

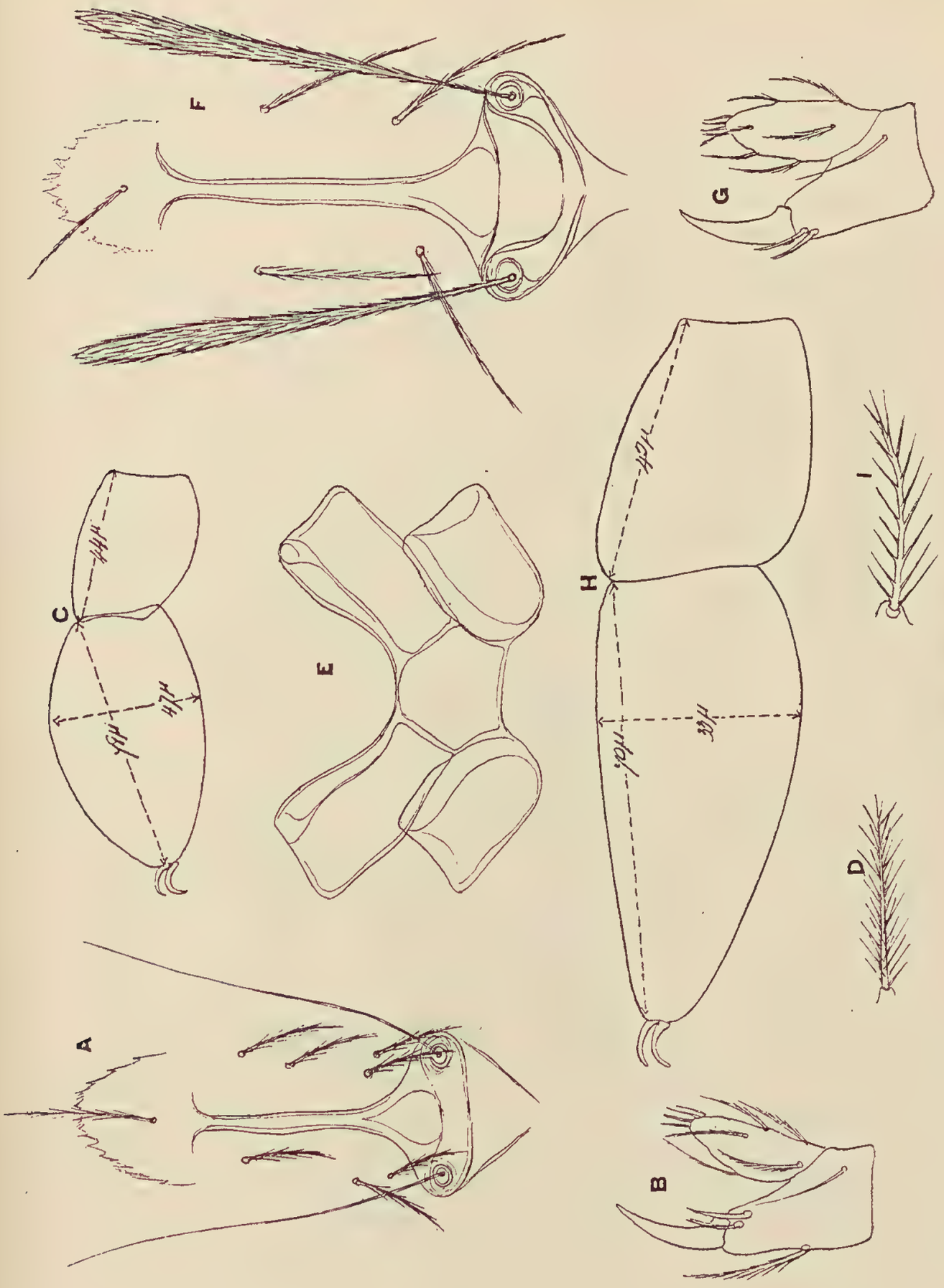

PLATE 105.

PLATE 106.

A–D. *Neoschöngastia gallinarum* (Hatori, 1920). Nymph: A, crista and epistome; B, palpal tibia and tarsus, inner view; C, front tarsus and metatarsus; D, posterior dorsal setae.

E–I. *Neoschöngastia carveri* Wharton and Hardcastle, 1946. Nymph: E, crista and epistome; F, palpal tibia, genu and tarsus, inner view; G, ditto. outer view; H, front tarsus and metatarsus; I, posterior dorsal setae (after Wharton and Hardcastle).

J–M. *Neoschöngastia* sp. n. Wharton and Hardcastle, 1946. Nymph: J, crista and epistome; K, palpal genu, tibia and tarsus, inner view; L, ditto, outer view; M, posterior dorsal setae (after Wharton and Hardcastle).

PLATE 106.

PLATE 107.

A–D. *Gahrliepia* (*Walchia*) *rustica* Gater, 1932. Nymph: A, crista; B, palpal tibia and tarsus, inner view; C, front tarsus and metatarsus; D, posterior dorsal seta.

E–H. *Gahrliepia* (*Walchia*) *lewthwaitei* Gater, 1932. Nymph: E, crista; F, palpal genu, tibia and tarsus, inner view; G, front tarsus and metatarsus; H, posterior dorsal seta.

I–M. *Gahrliepia* (*Walchia*) *disparunguis* (Ouds., 1929). Nymph: I, crista and epistome; J, palpal genu, tibia and tarsus, inner view; K, coxae I and II; L, front tarsus and metatarsus; M, posterior dorsal seta.

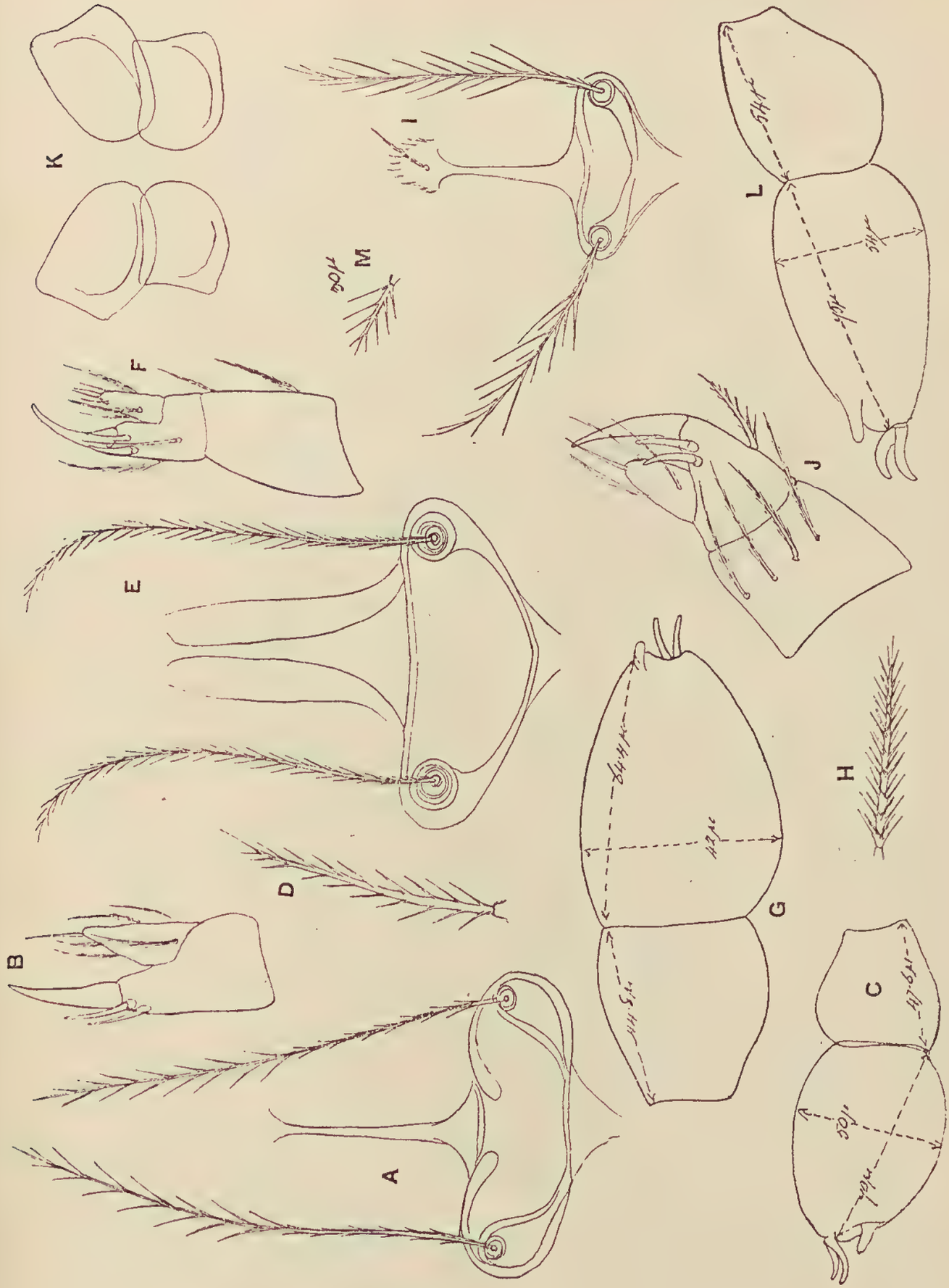

PLATE 107.

PLATE 108.

A–E. *Gahrliepia* (*Walchia*) *enode* Gater, 1932. Nymph: A, crista; B, palpal tibia and tarsus, inner view; C, ditto, outer view; D, front tarsus and metatarsus; E. Posterior dorsal seta.

F–J. *Gahrliepia* (*Schöngastiella*) *ligula* (Radford, 1946). Nymph: F, crista and epistome; G, palpal tibia and tarsus, inner view; H, ditto, outer view; I, front tarsus and metatarsus; J, posterior dorsal seta.

K–O. *Gahrliepia* (*Schöngastiella*) *punctata* (Radford, 1946). Nymph: K, crista and epistome; L, palpal genu, tibia and tarsus, inner view; M, coxae I and II; N, front tarsus and metatarsus; O, posterior dorsal seta.

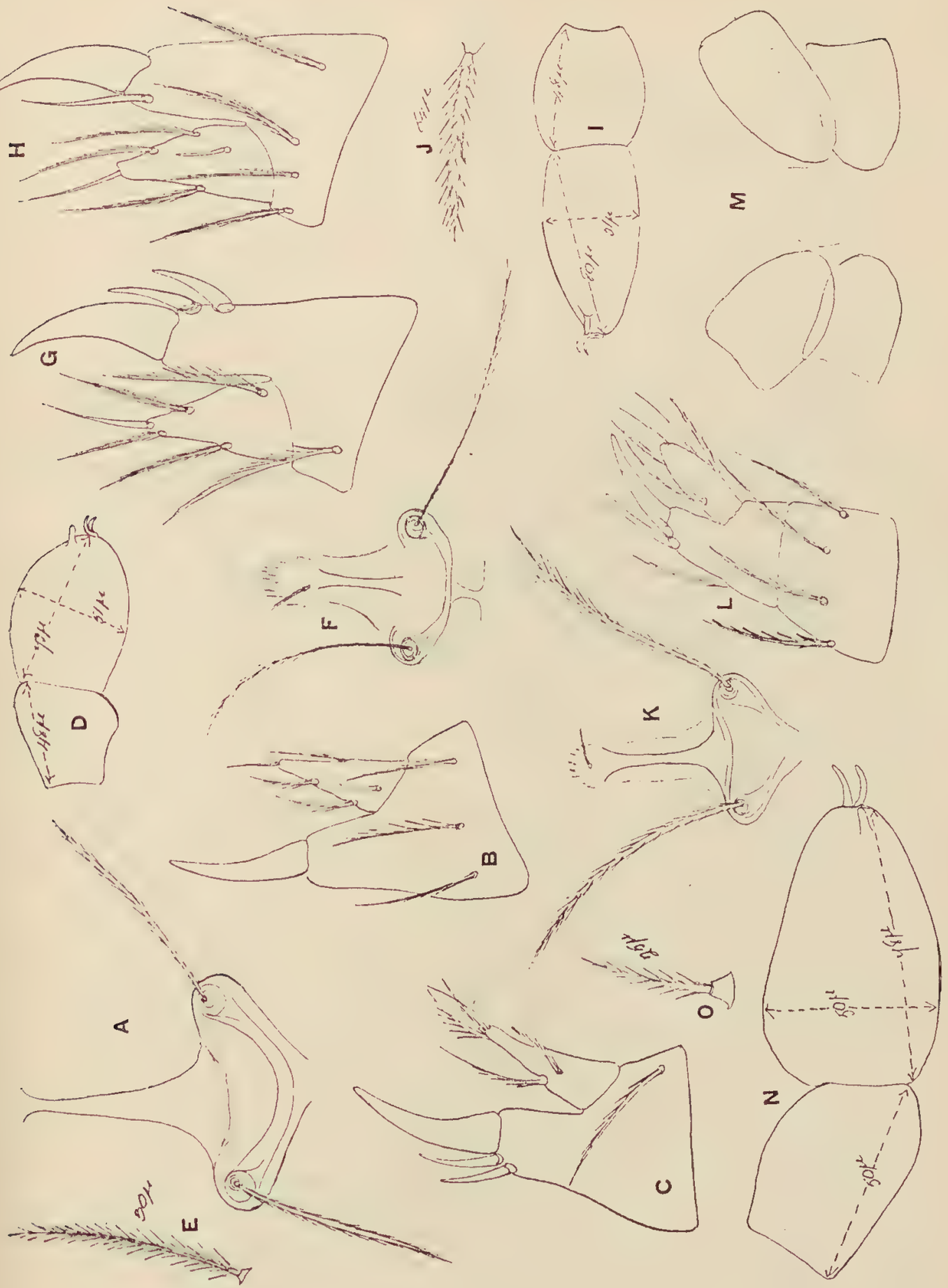

PLATE 108.

PLATE 109.

A–C. *Gahrliepia* (*Schöngastiella*) *ceylonica* sp. n. Nymph: A, crista and epistome; B, front tarsus and metatarsus; C, dorsal setae.

D–H. *Gahrliepia* (*Gateria*) *hirsuta* (Radford, 1946). Nymph: D, crista; E, palpal tibia and tarsus, inner view; F, ditto, outer view; G, front tarsus and metatarsus; H, posterior dorsal seta.

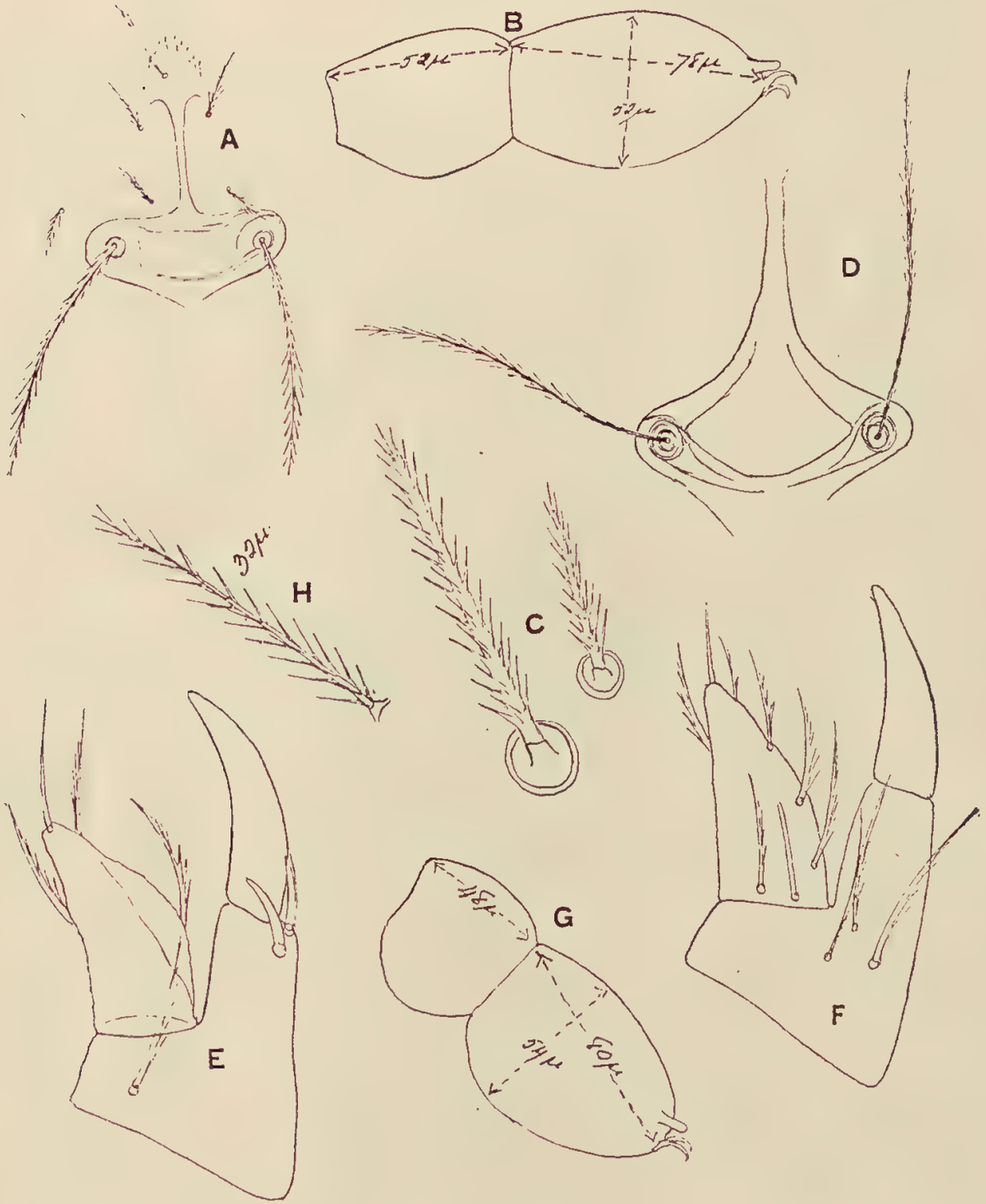

PLATE 109.

PLATE 110.

A–D. *Trombicula vietzi* sp. n. Larva. A. left dorsal and right ventral halves; B. scutum (× 500); C. palp; D. chelicera.

E–H. *Trombicula* (*Neotrombicula*) *consueta* sp. n. Larva. E. left dorsal and right ventral halves; F. scutum (× 500); G. palp; H. tip of chelicera.

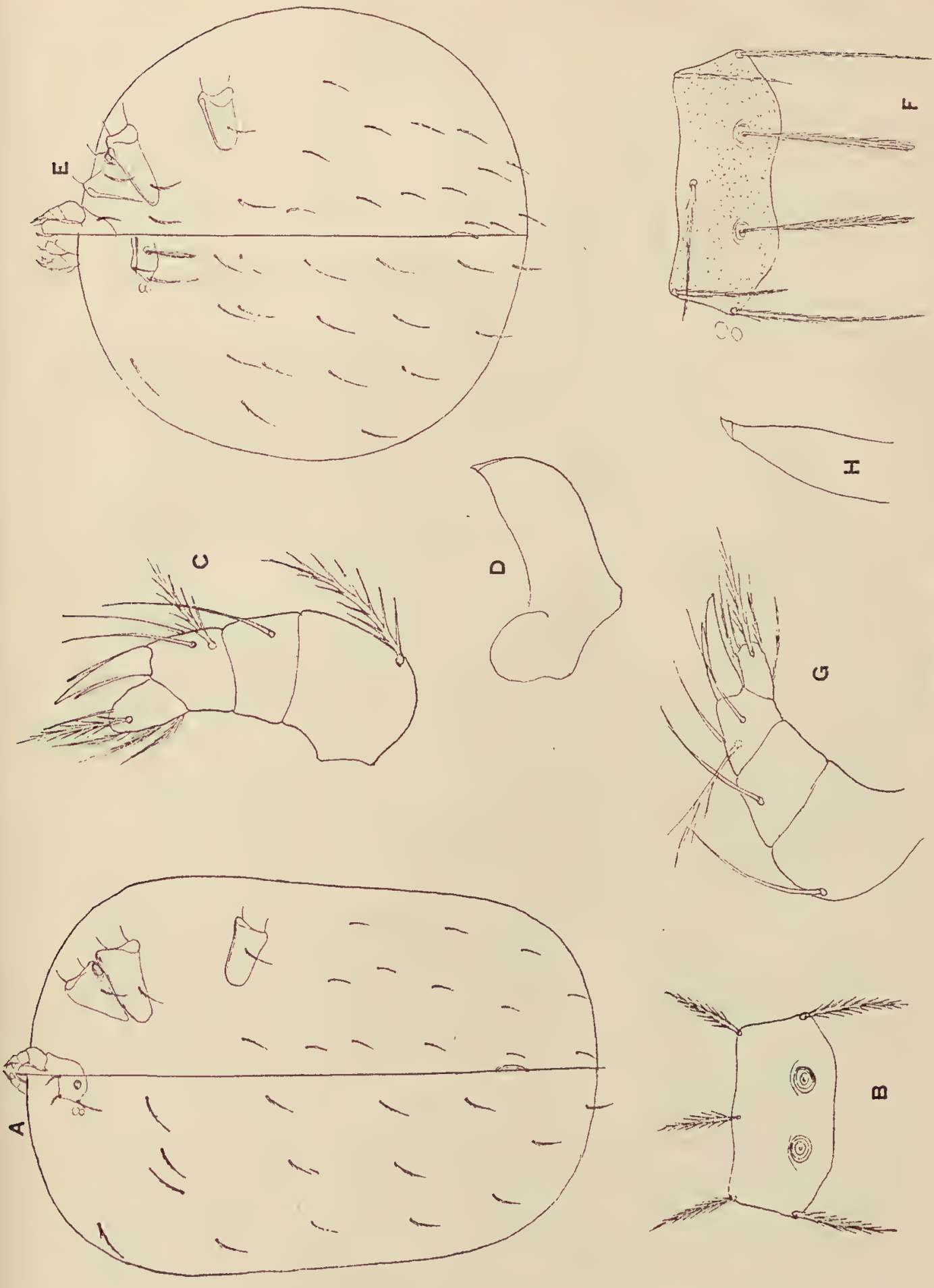

PLATE 110.

PLATE 111.

A–C. *Schöngastia* (*Schöngastia*) *lewthwaitei* sp. n. Larva. A. scutum (× 500); B. palp; C. tip of chelicera.

D–G. *Schöngastia* (*Ascoschöngastia*) *sarawakensis* sp. n. Larva. D. left dorsal and right ventral halves; E. scutum (× 500); F. palp; G. dorsal seta.

H–J. *Schöngastia* (*Ascoschöngastia*) *nadchatrami* sp. n. Larva. H. scutum (× 500); I. palp; J. tip of chelicera.

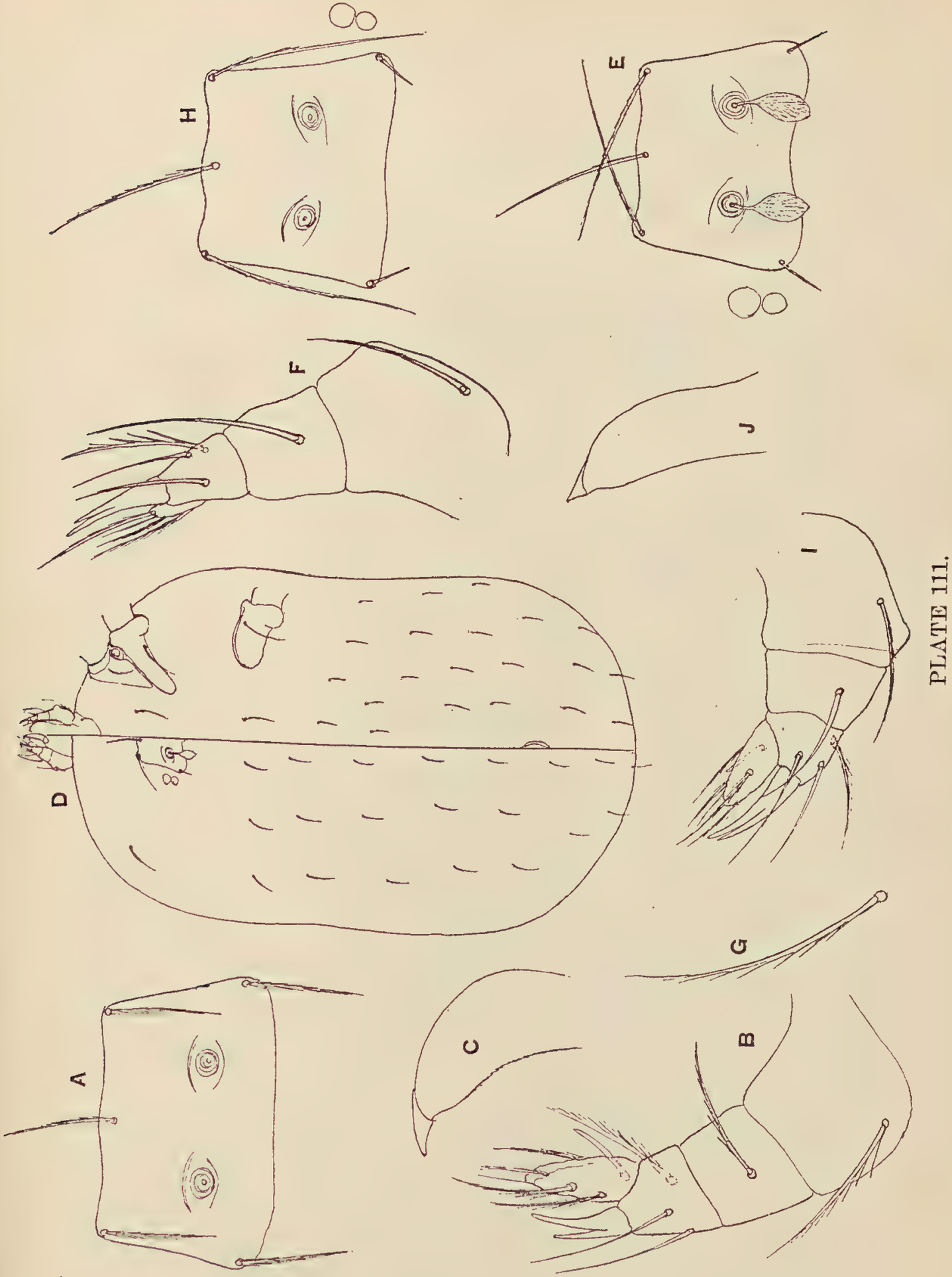

PLATE 111.

PLATE 112.

A–D. *Gahrliepia brennani* sp. n. Larva. A. left dorsal and right ventral halves; B. scutum (× 500); C. tip of chelicera; D. coxa III.

E. Ditto: var. *ventralis* nov. coxae II and III.

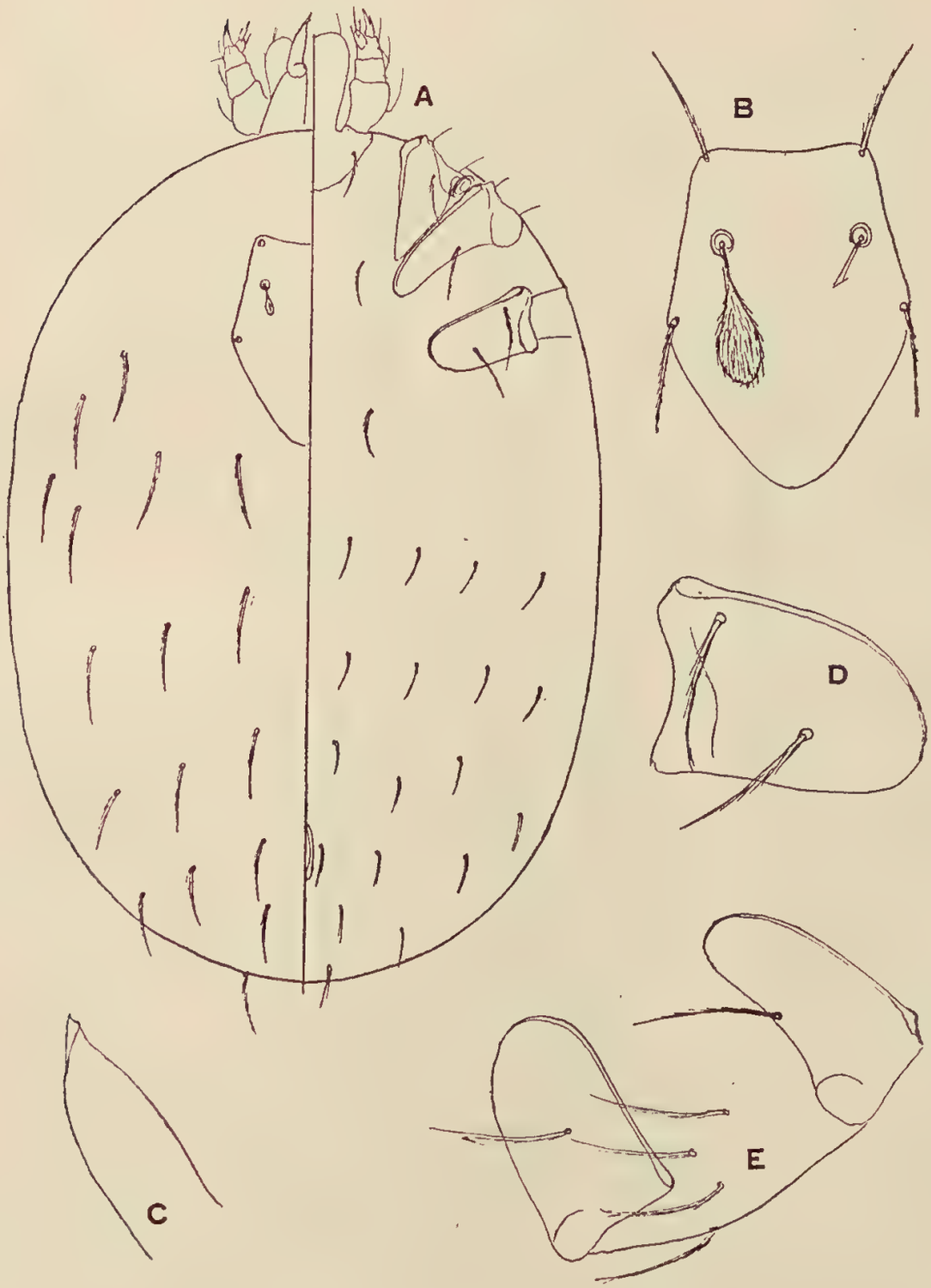

PLATE 112.

PLATE 113.

A–E. *Trombicula* (*Neotrombicula*) *harrisoni* sp. n. Nymph. A. crista and epistome; B. palpal tibia and tarsus; C. tarsus and metatarsus III. D. dorsal setae; E. coxae I and II and sternum.

F–I. *Heaslipia gateri* (Wom. and Heasp.). F. crista and epistome; G. coxae I and II and sternum; H. tarsus and metatarsus III; I. posterior dorsal seta.

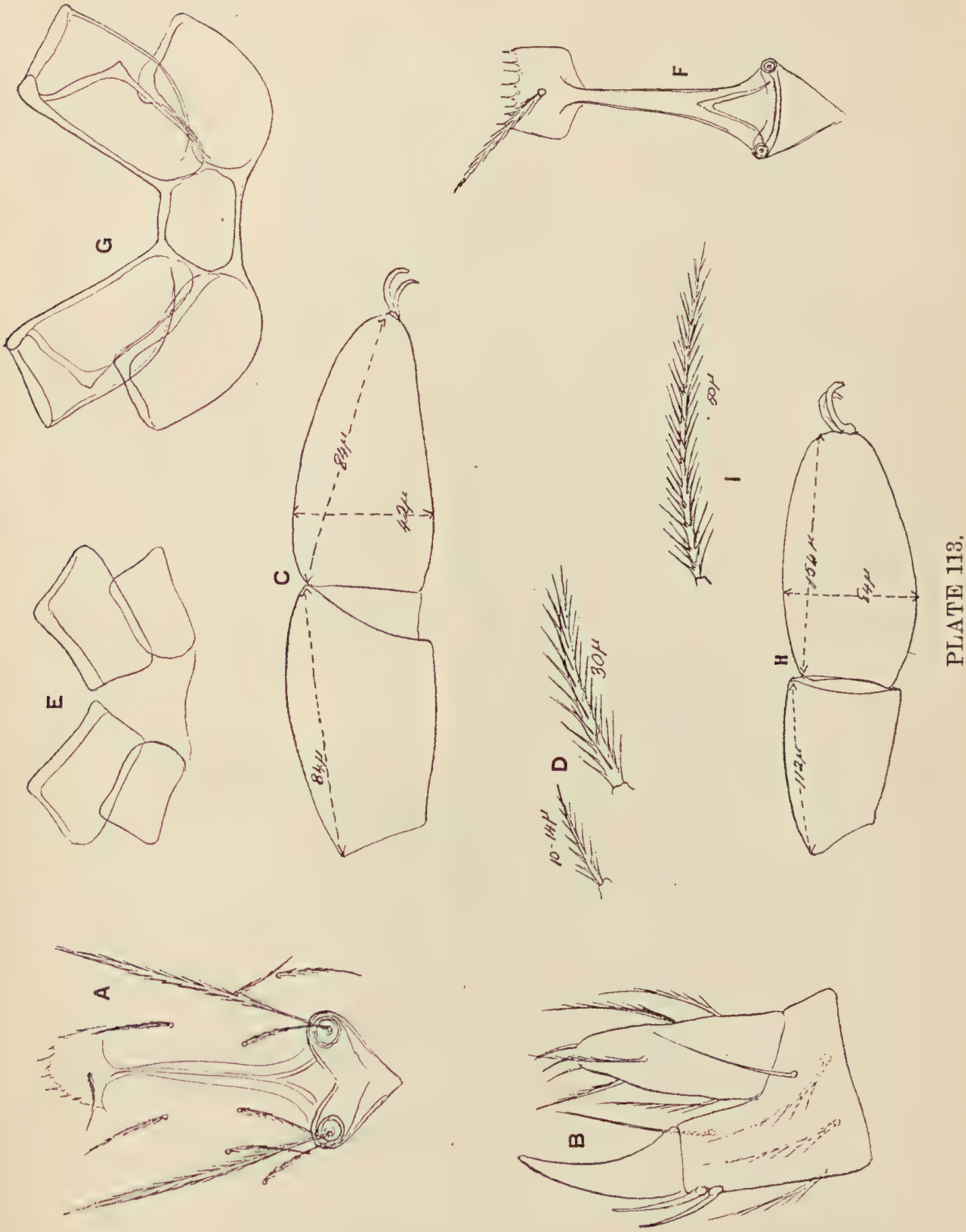

PLATE 113.

PLATE 114.

A–C. *Trombicula consueta* sp. n. Nymph. A. crista and epistome; B. tarsus and metatarsus III; C. posterior dorsal seta.

D–F. *Schöngastia* (*Ascoschöngastia*) *nadchatrami* sp. n. Nymph. D. crista and epistome; E. tarsus and metatarsus III; F. posterior dorsal seta.

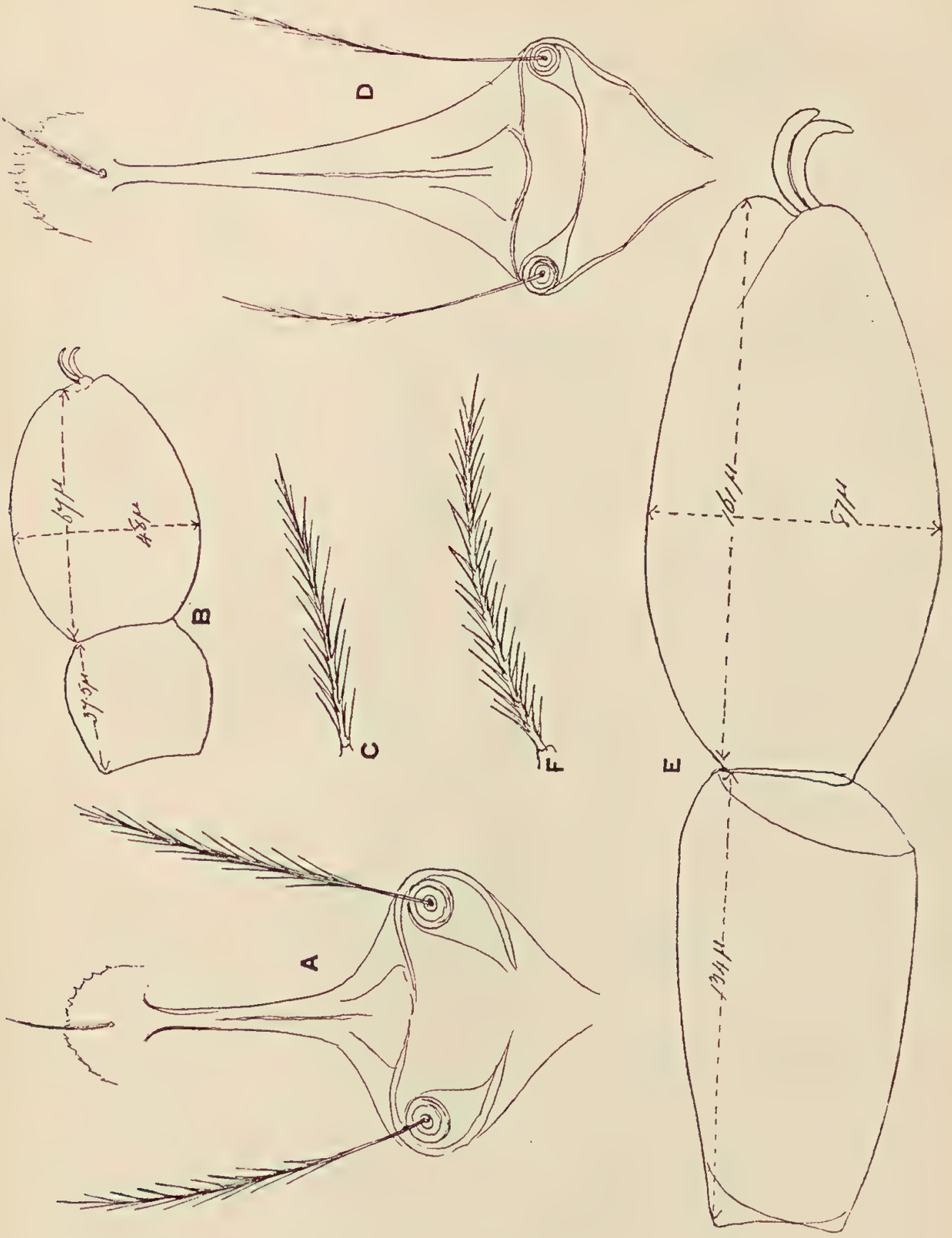

PLATE 114.

PLATE 115.

A–C. *Gahrliepia* (*Gahrl.*) *ciliata* Gater 1932. A. crista and epistome; B. tarsus and metatarsus III; C. posterior dorsal seta.

D–F. *Gahrliepia* (*Gahrl.*) *ornata* sp. n. D. crista and epistome; E. tarsus and metatarsus III; F. posterior dorsal seta.

PLATE 115.

PLATE 116.

A–E. *Trombicula thori* sp. n. Larva. A. left dorsal and right ventral halves, B. dorsal scutum (× 509); C. tip of chelicera; D. galeal seta; E. palp.

F–I. *Heaslipia gateri* (Wom. and Heasp. 1934). Nymph. F. crista and epistome (nasus), G. front tarsus, H. front metatarsus, I. posterior dorsal seta.

J–M. ? *Schöngastia samoaensis* sp. n. Adult. J. crista and epistome, K. front tarsus and metatarsus, L. coxae I and II and sternum, M. posterior dorsal seta.

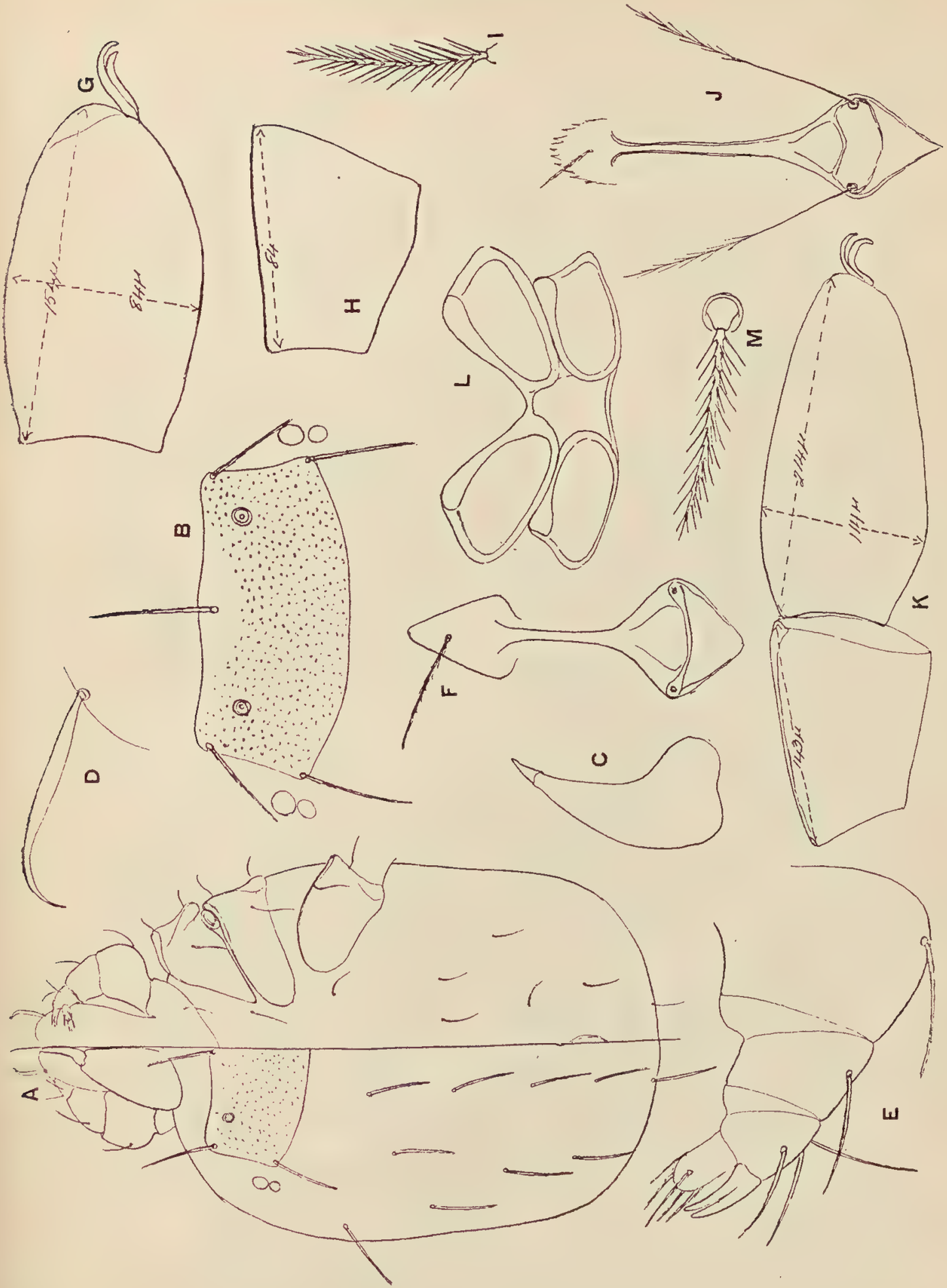

PLATE 116.

PLATE 117.

A–B. *Tragardhula nagayoi* (Sasa 1950). A. left dorsal and right ventral halves, B. dorsal scutum (× 500) (after Sasa).

C–D. *Tragardhula mitamurai* (Sasa 1950). C. left dorsal and right ventral halves, D. dorsal scutum (× 500) (after Sasa).

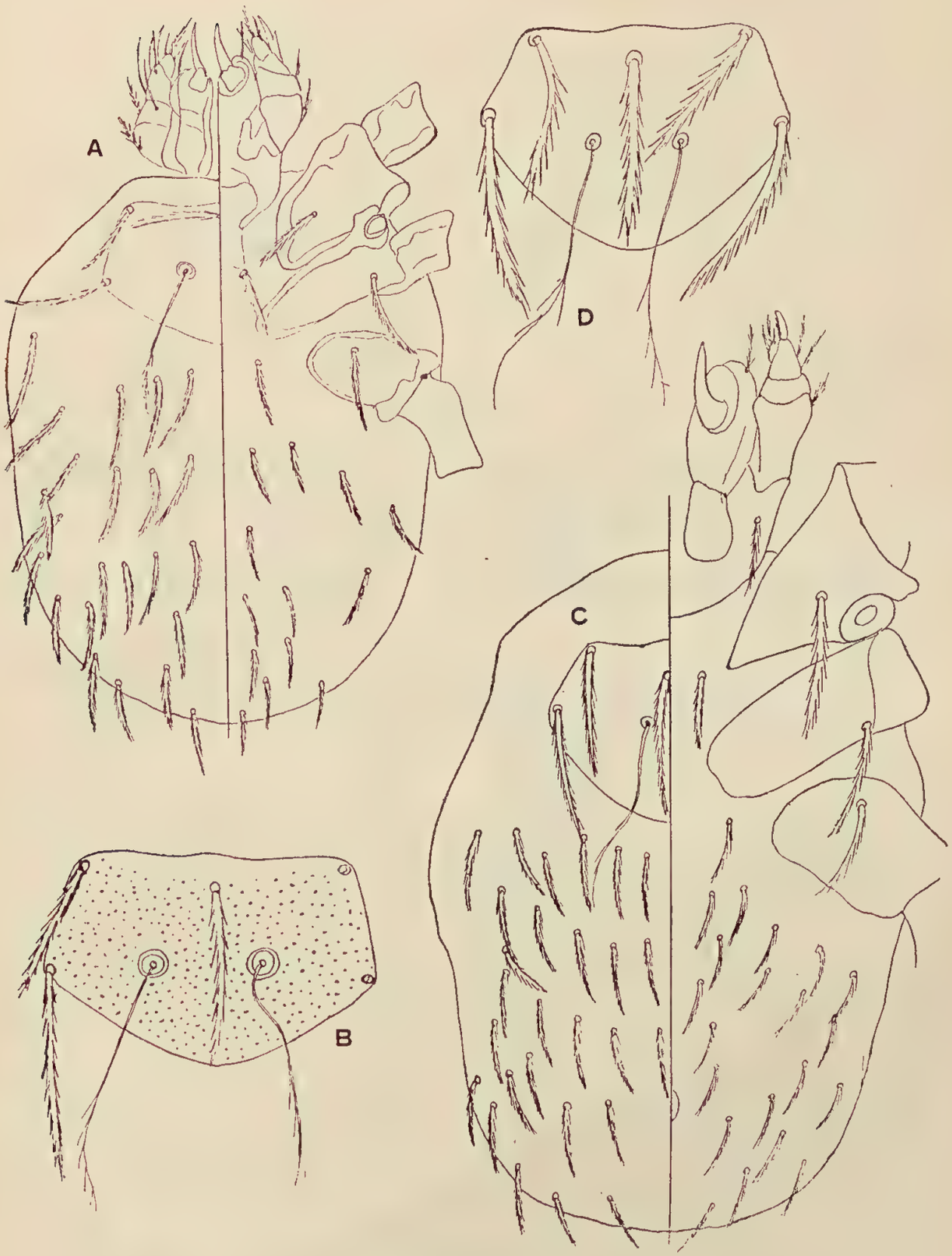

PLATE 117.

PLATE 118.

A–C. *Trombicula* (? *Leptotrombidium*) *burnsi* (Sasa 1950). A. dorsal view, B. dorsal scutum (× 500), C. palp. (after Sasa).

D–E. *Tragardhula nagayoi* (Sasa 1950). D. palp, E. end segments of leg III. (after Sasa).

F–G. *Tragardhula mitamurai* (Sasa 1950). F. palp, G. end segments of leg III. (After Sasa).

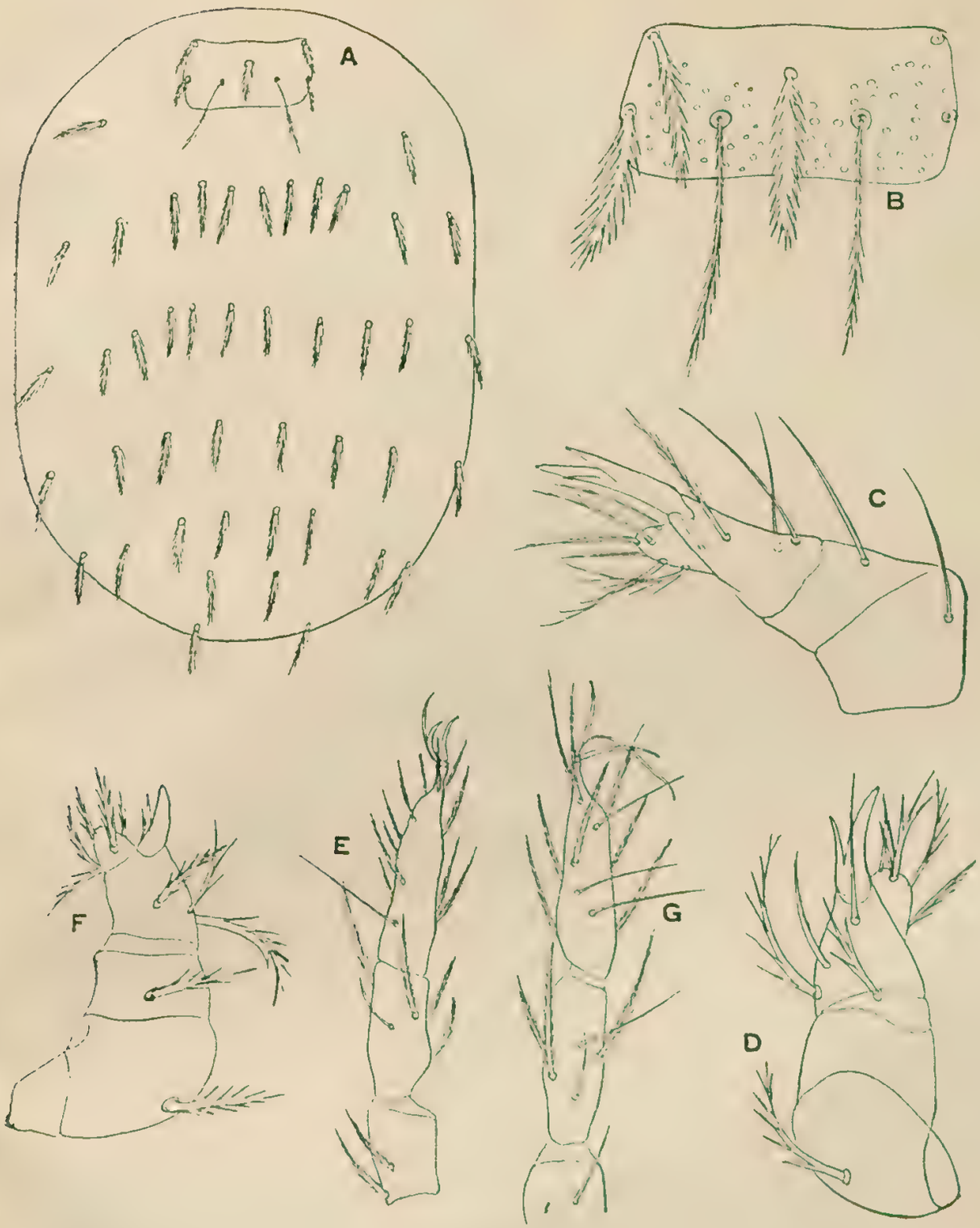

PLATE 118.

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